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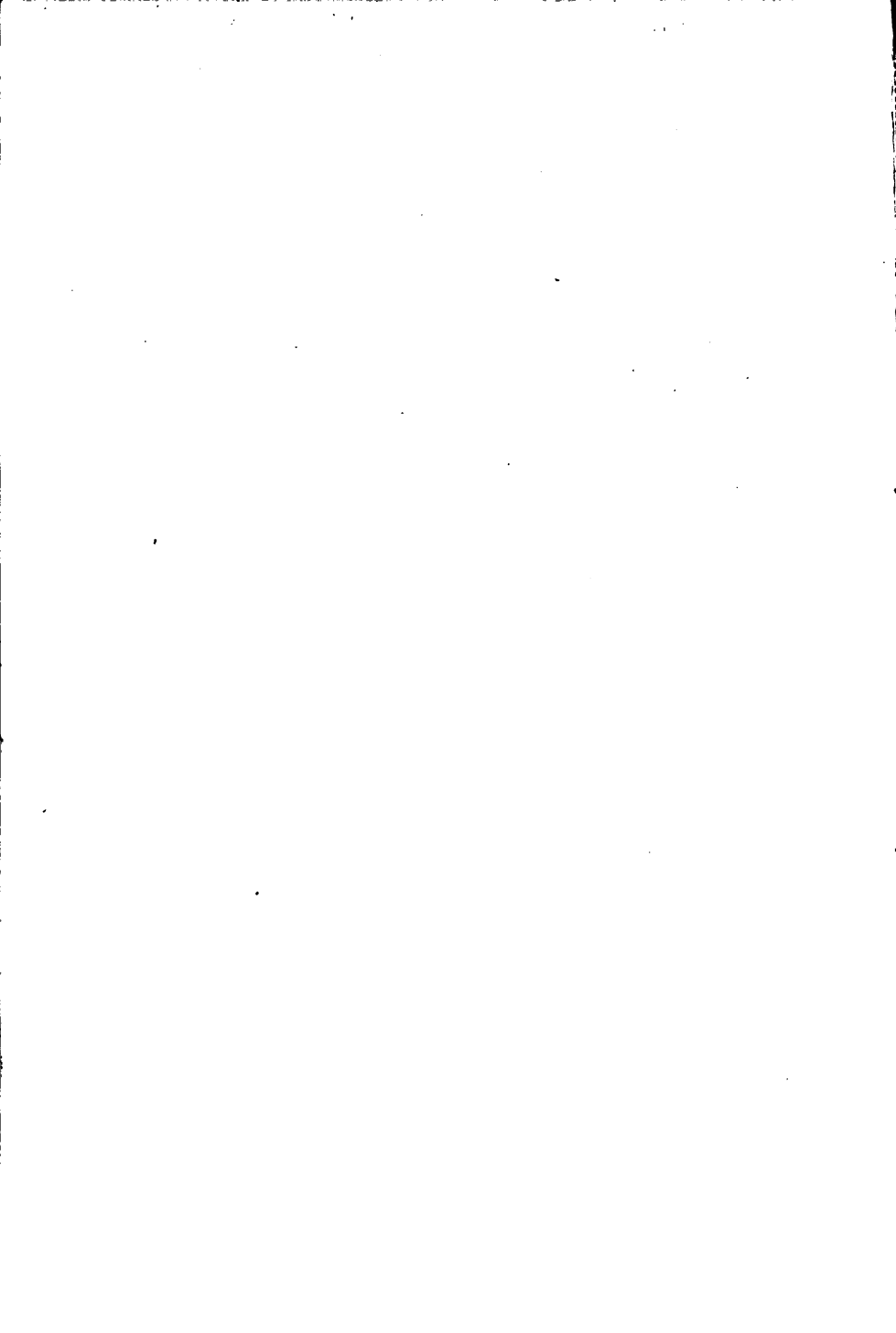


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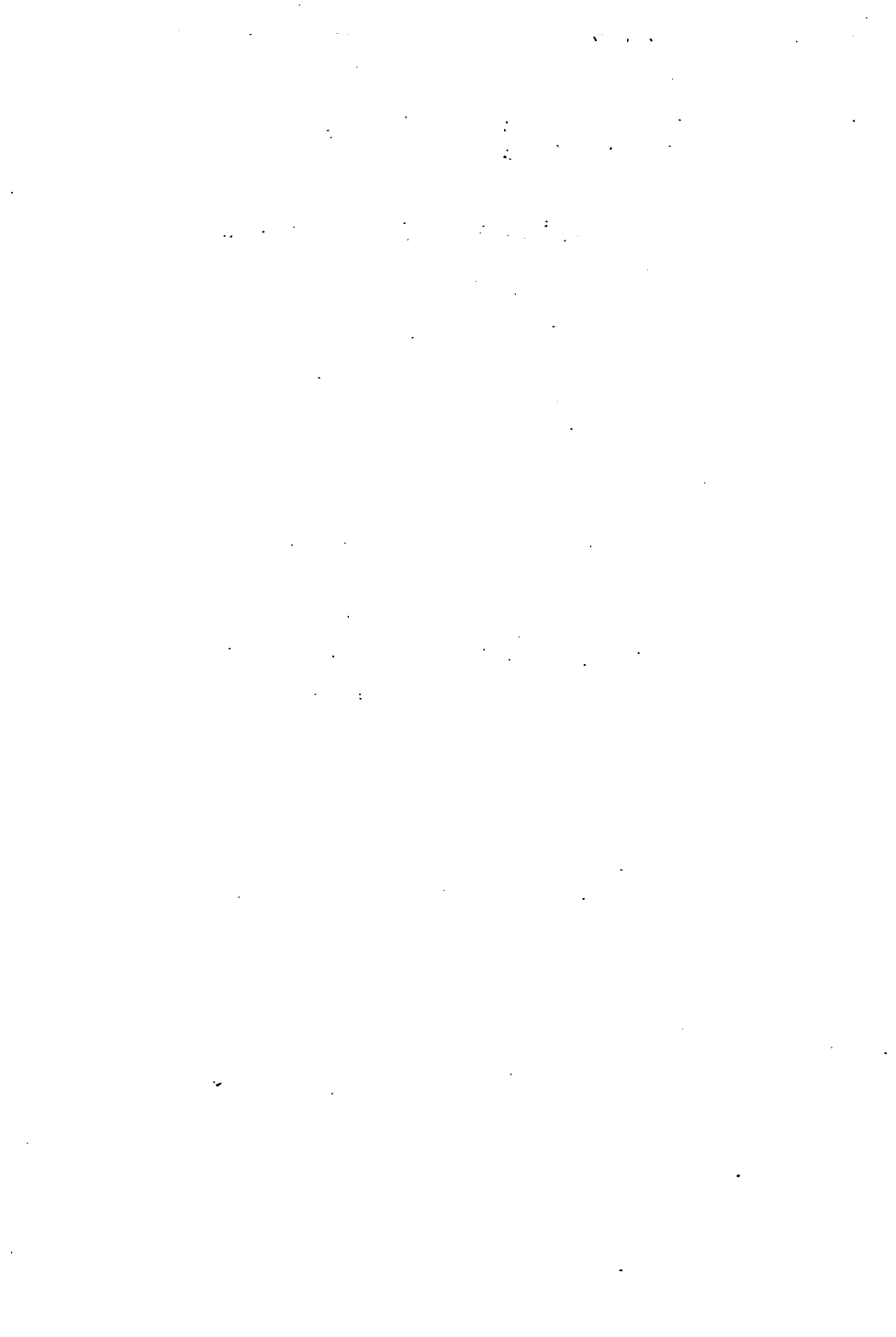
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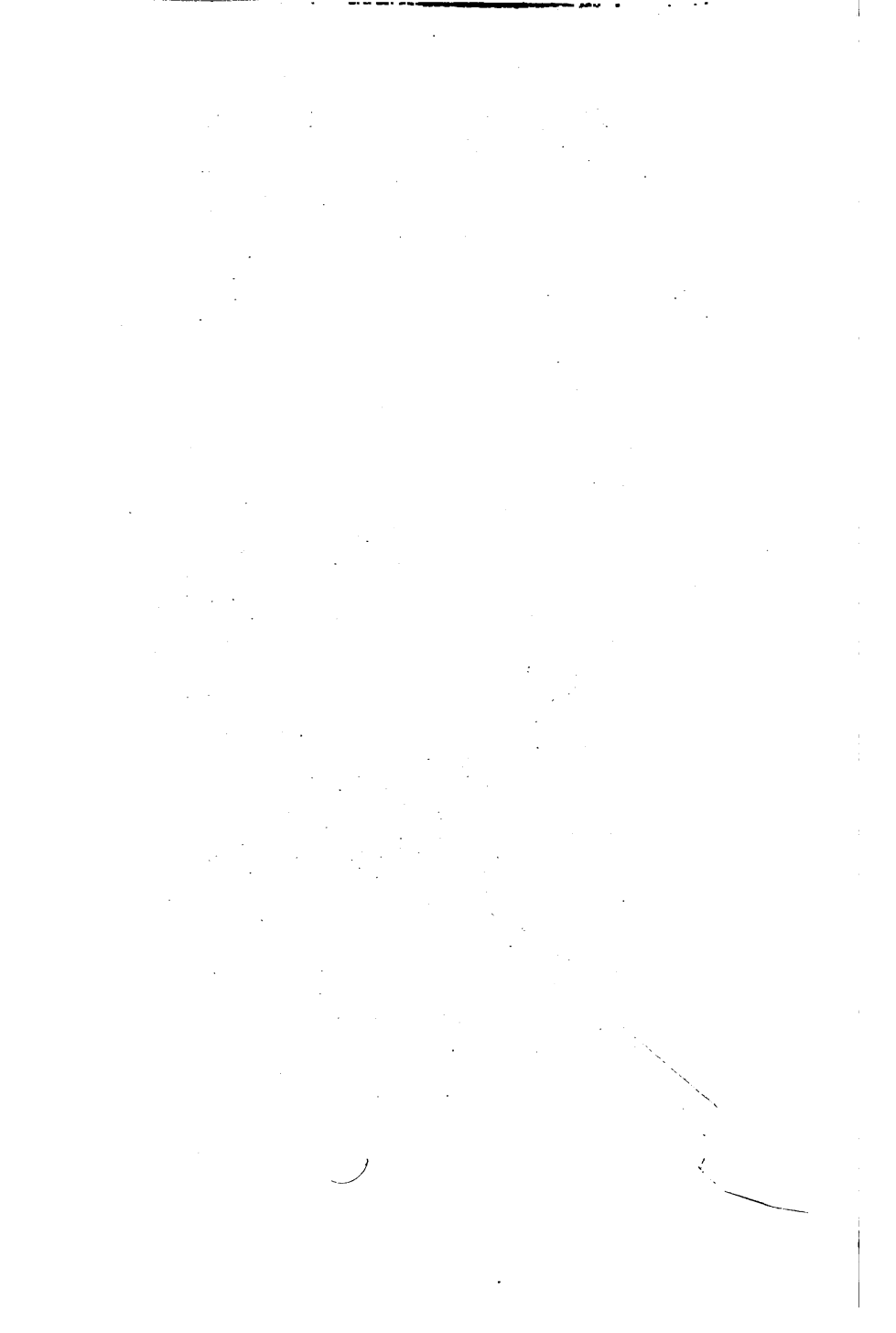
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FOOD SUPPLY:

A PRACTICAL HANDBOOK

FOR THE USE OF

COLONISTS AND ALL INTENDING TO BECOME
FARMERS ABROAD OR AT HOME.

BY

ROBERT BRUCE,

AGRICULTURAL SUPERINTENDENT TO THE ROYAL DUBLIN SOCIETY.

WITH AN APPENDIX ON

PRESERVED AND CONCENTRATED FOODS

By C. AINSWORTH MITCHELL, B.A. (Oxon.), F.I.C., F.C.S.

BEING VOL. II. OF THE "NEW LAND" SERIES,

EDITED BY PROF. GRENVILLE A. J. COLE, M.R.I.A., F.G.S.

WITH 49 ENGRAVINGS FROM PHOTOGRAPHS OF REPRESENTATIVE
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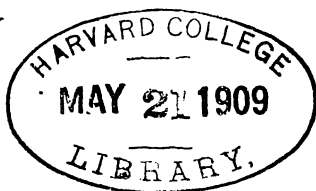
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PREFACE

THE amount of the Food Supply of the world, or at least that portion of it which is drawn from land, is largely dependent upon the cultivation of the soil. In some cases, cultivation has for its object the production of cereals and other crops, which directly form a considerable portion of the food consumed by man. In other cases, the land is cultivated and plants are grown to produce food for animals, which are destined to be slaughtered and become our principal meat supply; while, in ordinary farming practice, a combination of both systems is pursued. No doubt a certain portion of our food supply is obtained by the slaughter of wild and of domestic animals which have earned their living on land lying in a state of nature; but the amount thus derived constitutes so small a portion of the whole, that it deserves comparatively little consideration.

Taking it as granted that our Food Supply, directly or indirectly, depends upon the result of the work of those who cultivate the soil, the practical consideration of the methods pursued by British farmers, the crops they grow, and the live-stock they produce, may well form a basis of study for those who intend to become farmers, whether at home or abroad.

Farming may at once be said to be different from any other calling, in that the subjects which it embraces are varied in a degree unknown in any other profession or trade in which mankind may be engaged. The time was when a knowledge, acquired by practice, of such works as ploughing, sowing, and reaping was looked upon as suf-

ficient for a farmer. This, however, is altogether changed. Keen competition, the result of improved transit facilities, has led to daily increasing efforts in the direction of larger production at decreased cost. The Chemist, the Botanist, and the Mechanical Engineer have done much to further those efforts, and a knowledge of Chemistry, Botany, Engineering, and several other branches of the Arts and Sciences, in so far as affecting the cultivation of land, may now be said to be a necessity in connection with successful farming.

In the following pages no attempt will be made to instruct the student in all the branches of education now so necessary to be mastered by those who intend to pursue the occupation of farming, whether at home or in a new country. It is, however, the intention of this work to touch upon a few of the principal factors connected with Food-Production, as commonly carried out, with the view of assisting those who may not have had the opportunity of receiving a technical education bearing upon the subject of farming.

Such an education, seeing that it affords facilities for acquiring a knowledge of the fundamental principles of improved cultivation, entails a thorough course of training, only to be obtained by attendance at one or other of those Agricultural Schools or Colleges which are daily becoming more numerous in every country in the world.

No clear or distinct lines can be laid down to suit the many different systems of farming, where the circumstances and surroundings may, and do, vary in a wide degree; but while this is the case, the author's experience at home and abroad has assured him that there are many fundamental principles connected with farming which may be said to be applicable under all circumstances. These relate to crops which are more or less universally grown, to the methods pursued in their cultivation, the returns they yield, and the purposes they serve; and, further, to the breeding and general management of live-stock. Such

subjects, although perhaps differing in many details, must be understood if success is to be the result of farming in any part of the world.

In the portion of the work devoted to live-stock, a number of reproductions of photographs of representative animals have been introduced. These, it is believed, show the distinctive qualifications of the different breeds, in a more forcible way than any lengthy description could possibly do. In one respect the collection given is unique, as the pictures are not reproductions of paintings, prints, or other imaginative likenesses, but, with two exceptions, are reproductions from **life-photographs**. The author is deeply indebted to the many friends who so readily furnished him with photographs of their animals. In a special degree is he under obligation to the editor of the *North British Agriculturist*, whose store of photographs was unreservedly placed at his disposal. Some excellent illustrations have also been supplied by the editor of the *Live-Stock Journal* and the *Mark Lane Express*. Several of the leading implement-makers and their agents having furnished drawings of improved implements in general use, these are given in the belief that they will prove both interesting and instructive to agricultural students.

In an Appendix, the subject of **PRESERVED FOODS** has been dealt with in a concise but instructive way by a writer who has made a special study of the subject.

R. B.

DUBLIN, *May*, 1898.

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FOOD SUPPLY

CHAPTER I

CLIMATE AND SOIL

CLIMATE :—Amount of annual rainfall and its distribution over the year
—Situation and aspect of a farm. **SOILS** :—Heavy and light—Nature of the subsoil to be considered—Fertility of the soil—Plants as an indication of the quality of the soil—Mechanical condition of the soil
—Action of earthworms.

CLIMATE.

A FARMER may be said to be entirely dependent upon the weather, and, in consequence, it is all-important that the climatic conditions of a country should receive his careful consideration. While this is especially true in the case of a settler in a new country, it holds good in older and better-known countries, where, through natural causes, great varieties of climate are experienced within very prescribed areas. The duration of the summers and winters, with their mean temperatures, ought to receive attention, while the amount of the annual rainfall must always be considered a matter of the highest importance.

Annual Rainfall and its Distribution over the Year.—

Knowing the annual rainfall, it is equally important to ascertain the particular seasons of the year at which, under ordinary circumstances, rain may be expected to fall. Many instances could be quoted of men having successfully farmed land which was looked upon as poor and where the climate was generally acknowledged to be bad, who had nevertheless utterly failed to make a living after they moved to a district known to possess a better climate and a richer soil. These failures, no doubt, arose through

attempts being made to grow crops and to conduct farming operations on a system unsuited to the country and to the peculiar distribution of the annual rainfall in the new locality. Before, therefore, attempting to decide upon the nature of the crops to be grown in any particular country, it is necessary to become conversant with the annual rainfall during the different seasons of the year. Wheat, for instance, may be successfully grown in a district where the amount of rain falling in March, April, May, June, and July is small; whereas barley and oats under such circumstances would be comparative failures. The fact that large breadths of strong clay soils have gone out of cultivation, although situated near the greatest market in the world, has times without number been referred to and explained. Doubtless the land is heavy and expensive to work, and wheat has fallen below a price at which it can be grown on certain soils with profit; but could the rainfall of these derelict districts be distributed over the various seasons of the year in such a way as to allow the land to be worked for the cultivation of other crops than wheat, we may safely take it as granted that not one acre of arable land within a reasonable distance of London would be found tenantless. This may seem a purposeless argument, seeing there is no possibility of our being able to change the seasons in Essex, or to regulate its rainfall so that men could profitably grow oats and roots; but such a prominent example shows the importance of carefully considering the *seasons* of the year at which rain may be expected to fall, seeing this has much more influence upon the crops which may be grown than the gross amount of rainfall which a district may safely expect to receive.

Situation and Aspect of a Farm.—Another most important matter to be considered is the situation and aspect of a country, district, or farm. In a late climate or at a high elevation, the advantages of a southern aspect are well known and fully appreciated by practical farmers. It is interesting to observe how land reclamation has crept up the southern sides of many of our mountains, extending, in many cases, hundreds of feet beyond the crop-growing limits on the northern sides. Along with the natural shelter from prevailing winds afforded by hills and mountains, such artificial shelters as forests, or even plan-

tations of trees, exercise a beneficial influence upon the climate of a district or a farm. One has only to look at the plantations near a sea-coast to thoroughly appreciate the value and the result of shelter. In such a situation, where a wall has been built and a plantation formed, the trees immediately behind the wall are stunted, twisted, and have never attained a height much above the level of the wall-top; and yet they form the beginning of a gradually increasing height of timber, until, at perhaps twenty or thirty yards from the wall, we find full-grown forest trees affording shelter from the prevailing winds to wide fields of arable or grass lands.

SOILS.

The origin, physical formation, and chemical composition of soils are subjects which deserve the careful consideration of all engaged in agriculture. Geology as a science ought to be carefully studied by all who mean to become farmers, as the knowledge of the geological formation of a soil and subsoil is of the utmost importance in determining its value or suitability for the growth of particular crops.

Soils, Heavy and Light.—**Soil**, the term used by farmers when speaking of that portion of the earth's surface likely to be worked or cultivated, is by them considered to belong to two great classes—heavy and light; these terms have reference to the labour required to work the soils, not to their relative specific gravities.

Clay soils are known as heavy, while sand, gravel, chalk, and peat are spoken of as being light.

Nature of the Subsoil an Important Consideration.—In forming an opinion regarding the fertility of a particular soil, the strata immediately underlying it, known as the **subsoil**, must receive attention. For instance, a clay soil resting upon gravel is, in practical farming, altogether different from such a soil resting on a retentive subsoil; and in like manner the value of a light soil depends much upon the nature of the subsoil underlying it.

Fertility of Soil.—The nature and growth of plants on the surface of a soil may be said to be a safe indication of its fertility. In forming an opinion regarding the capa-

bilities of a soil based upon such an indication, every care must be taken by those engaged in land prospecting to make allowance for climatic conditions. In many of our colonies and other countries, where, through long-continued droughts, land is of very little practical value, the vegetation immediately after a rainfall clearly shows the capabilities of the soil, while the total absence of the appearance of plant life during the seasons of drought tells the effects of the climate. In the South-Western States of America and Northern Mexico, where cattle ranching is the principal industry, ten to fifteen acres are generally put as the extent of grazing ground allowed to each head of cattle; and yet, if seen at certain seasons of the year, the grass on these lands would indicate a grazing capacity where the number of animals per acre ought to be a consideration rather than that of the number of acres to be allotted to each animal.

Mechanical Condition of Soil.—There is at the present time a tendency to undervalue the importance which ought to be attached to what may be termed the mechanical condition of the soil. It is possible to imagine a soil which, if analysed, may be pronounced by the chemists to contain such elements as ought to render it highly productive, and yet it may be practically valueless. If, however, we mix with such soil a substance having little, if any, chemical manurial value, we may at once change its mechanical condition and render it capable of growing profitable crops. On this account it is most unsafe to dogmatise regarding the manurial values of such substances as straw or farmyard manures, or to form an estimate of chemical manures as if they had a definite action under all circumstances.

Perhaps the most important agents affecting the mechanical condition of that portion of the earth's surface spoken of as "soil" are the common earthworms; and therefore such manures or systems of land preparation as tend to encourage the presence of earthworms must beneficially affect the crop returns. Some idea of the enormous work carried on by earthworms may be gleaned from the fact, as stated by Darwin, that in many parts of England "the whole superficial bed of vegetable mould passes through their bodies in the course of a very few

years." Were we to speculate simply upon the effects resulting from the action of the worms in mixing, chemically changing, and bringing annually to the surface many tons of earth per acre, we could not fail to acknowledge the enormous importance of the work. Nor does it end here; their burrows, often of a great depth, open up the soil to the action of the sun and air, and at the same time form drains to carry the surface water to the subsoil, where it exercises an influence difficult to over-estimate.

CHAPTER II

DRAINAGE AND ROTATION OF CROPS

Importance of **PROPER DRAINAGE**:—The construction of drains—Level and outlet—Trenches and pipes. **ROTATION OF CROPS**:—Old and modern views—"Bare fallowing"—Benefits of leguminous crops—Examples of rotation: a four-years', five-years', and six-years' course—Adaptation to circumstances necessary.

DRAINAGE.

Importance of Proper Drainage.—Land may be rich in plant food and yet practically valueless for the growth of field plants, on account of the excessive amount of water in the soil or subsoil. Being what is termed "**water-logged**," the action of the air is impeded. This of itself is sufficient to check the growth of field plants; but when we consider the necessary lowering of the temperature, as caused by the evaporation of water in wet soils, the importance of draining such soils must be at once apparent.

The Construction of Drains.—The first and most important matter to be considered in draining any tract of land is to make sure that there is an outlet sufficiently below its level to allow the surplus water to run off. Levels must be carefully taken, and the main drain, into which the subdrains discharge, must have sufficient fall, with an outlet at a lower level than the lowest portion of the field intended to be drained. This being assured, the main drain should be cut from this outlet along the lowest portion of the field, and into this main the subdrains should discharge their several streams.

If the subsoil is of a porous nature, drains may be put at wider intervals than in one of a more retentive nature; and in strong clay soils, where the surface water alone has to be got rid of, drains should not be cut so deep as in lighter soils where underwater is the cause of the soil being water-logged.

Trenches and Pipes.—In many parts of the country where stones are plentiful they are used to form a course

for the water along the bottom of the trench or drain. Where stones are not available, pipes made of burned clay are used, and when carefully laid on a well-prepared surface at the bottom of the trench they are most satisfactory. These pipes are from 12 to 15 inches in length, and the sizes now generally used have an inside diameter of 2 inches for subdrains, and 3 or 4 inches for mains. If pipes are to be used, the drains are cut as narrow as a man can work in them, the width at the bottom being little more than the width of the pipes.

Where the subsoil is strong clay, a firm, well-formed bottom may, with ordinary care, be easily obtained, so that pipes can be laid end to end without any joint or collar. In filling the drains, however, after the pipes are laid, it is all-important that every care should be taken that the pipes are not displaced.

When the bottom of the drain is of a sandy or peaty nature, the pipes are joined by movable collars about 3 inches in length, and of sufficient diameter to admit the ends of two pipes; these meet in the centre of the collar, and being thus jointed together, they are less liable to become displaced. If the bottom is unsound, thin boards from 4 to 6 inches wide are often placed below the pipes to keep them in position.

When stones are used, the bottom of the trench is generally cut about 6 inches wide and filled to the depth of 12 to 15 inches with broken stones; this, as a rule, is considered sufficient for subdrains. Main drains formed of stones must be built in the form of culverts, so that the water from the subdrains may have a clear course.

ROTATION OF CROPS.

As farming is pursued in Great Britain, certain rotations or courses of crops, differing much in different localities, are systematically carried out. These rotations have been fixed after practical experience had taught farmers in the several districts the best and most economical system of land management. Before chemistry, as applied to agriculture, was known or thought of, practical experience had taught our forefathers that change of crops was absolutely necessary before the profitable production of crops could

be expected. Cereals followed by cereals meant decreasing crops with an increasing quantity of weeds; while experience also proved that, when land had to be prepared for different crops, under different circumstances, and at different seasons of the year, the farmers were enabled to keep the weeds in subjection, while a change of crops, and allowing it to lie in grass, was credited with "giving the land a rest." We now know, being taught by scientific observation, that a well-arranged rotation of crops does more than rest the land and afford facilities for the destruction of weeds.

A **leguminous** crop, such as clovers, beans, &c., instead of robbing the soil of such nitrogen as it may contain, actually supplies this element, and leaves for the succeeding grain crops a store of one of the principal elements necessary in the profitable growth of cereals. The earlier rotation of crops grown was one by which one, two, or three cereal crops were taken, to be followed by "bare fallowing," which meant allowing the land to lie without a crop, but to be repeatedly turned up by the plough. These repeated ploughings answered two purposes: the land was subjected to the beneficial action of the sun and air, while the weeds which had established themselves during the growth of repeated cereal crops were got rid of. Sometimes a crop of beans or peas was taken, thus admitting of a longer interval between each fallowing. When root crops, such as turnips, came to be grown, and bare fallowing, except in the case of strong clay land, given up, the four-course system of rotation became common.

The ordinary four-course rotation is one largely practised, and is often spoken of as the Norfolk four-course, as for example:—

1. Wheat, oats, or barley.
2. Roots.
3. Barley or oats.
4. "Seeds," *i.e.* grasses and clovers to be cut and made into hay.

An example of the five-course system may be put as:—

1. Wheat, oats, or barley.
2. Roots.
3. Barley or oats.
4. Seeds either pastured or cut for hay.
5. Seeds pastured.

This rotation is common over a large extent of land in Scotland, where the fourth and fifth years' crops are grazed with cattle, instead of being cut for hay, thus leaving the land in good condition for the following grain crop. Grazing cattle on first year's grass grown on heavy clay soils is impracticable, as in wet weather the animals would trample and practically destroy the young grasses and clovers.

The six-years' course is often similar to the above, with the third year's grass added, or it may be :—

1. Wheat.
2. Roots.
3. Barley.
4. Seeds.
5. Oats.
6. Beans or potatoes.

The above examples give a general idea of rotations as pursued in many parts of the British Isles; but they by no means exhaust the details of the many systems which experience has taught farmers to adopt. Corn crops should, as far as possible, be preceded or followed by roots, beans, potatoes, or clovers and grasses, the rotation being so arranged that the crops grown may suit the requirements of the farm in the matter of food for stock. On friable soils a larger breadth of roots may, of course, be grown than would be profitable on heavy clay, where beans or clovers would, in all probability, take the place of turnips, mangels, or potatoes.

CHAPTER III

SEEDS AND CROPS

Importance of care in the **SELECTION OF SEEDS** :—Tests of the quality of seeds : *a.* Germinating power ; *b.* Colour and smell—Danger of selecting seed from “heated” grain—The dressing of grain selected for seeds : its importance. **WHEAT** :—“Winter wheat” and “spring wheat”—Sowing and harvesting—Value of wheat-straw. **BARLEY** :—Qualities required in malting—Barley in crop rotation—Harvesting. **OATS** :—Varieties—Oats as food for cattle and for man. **RYE** :—Its hardy properties. **POTATOES** :—The potato disease—“Spraying” as a remedy—Planting : drills *versus* “lazybeds”—Seed potatoes—Storing of potatoes. **TURNIPS** :—Common varieties—Protection against frost. **MANGEL-WURZEL** :—Precautions in storing. **CABBAGE** :—As a forage plant. **PASTURE GRASSES** :—How to form permanent pastures—Preparation and mixtures of grasses.

SEEDS.

ONE of the most important matters connected with arable farming is the careful attention necessary in the selection of seeds. In many cases this is overlooked, and much loss results, either through the purchase of cheap seeds, carelessness in proper selection, or in the neglect of the proper cleaning and selecting of the farmer's own supply.

In the first place, if the seed has to be bought, it should be borne in mind that it is much better to save money in the quantity than in the quality of the seeds. While this is true in such large seeds as wheat, barley, oats, &c., it is much more so in the case of smaller seeds, such as grasses, clovers, turnips, &c.

It cannot be expected that farmers, as a body, can become expert judges of all the different seeds they require ; and in the case of those they have to purchase, more especially the smaller and more delicate seeds, they may safely place themselves in the hands of respectable seedsmen. If they do so, they will find they are invariably advised to pay a fair price for a good article, rather than depend upon the cheaper sorts.

It will be found in practice that even the best samples of the smaller seeds have, in some seasons, a hard battle to fight to hold their own against inclement weather, destructive insects, and other enemies which would totally destroy the products of seeds of a poor quality.

Tests of the Quality of Seeds:—a. Germinating Power.

—An opinion is very commonly held that the quality of small seeds may be judged by their germinating powers. A common and very simple plan of testing seeds is to place a carefully counted number upon a damp woollen cloth in a temperature such as is maintained in a dwelling-house, and after a few days to count the number which have sprouted, so as to determine the percentage germinating. Of course the damp condition of the cloth has to be maintained, while the length of time the seeds take to germinate must depend upon the surrounding temperature, and the nature and thickness of their skins or outer coverings.

The germinating test up to a certain point is, no doubt, a criterion of the quality of seeds; but it can be easily understood that weak seeds may show well under the artificial system pursued in testing their germinating powers, and yet in the open fields they may be utterly unable to sustain life till the plants are able, so to speak, to forage for themselves. Even if the plants from weak seeds do maintain an existence, they never gain sufficient vigour to become profitable crop-producers.

b. Colour and Smell.—In the case of grain, colour is one of the simplest and most reliable tests, and one which can be easily applied. All good wheats and barleys ought to have that bright golden appearance which can at once be recognised. If this colour is naturally present, and the grain is firm and dry, there is little doubt but that it will germinate. In judging the quality of grain, the sense of smell is of much value, and musty-smelling grain ought to be at once put aside.

Danger of Selecting Seed from "Heated" Grain.—Grain, either through being stacked in the straw before it is in a fit state to be put together in quantity, or put into a heap in a damp or raw state after being threshed, ferments and becomes what is termed "heated."

The effects of heating may generally be detected by the dull yellow colour of the skin of the grain, and by its peculiar pungent flavour if eaten. Grain that has been heated, even to a small extent, is very unsuitable for seed, and in many cases its germinating power is utterly destroyed.

If a farmer is depending upon his own grain for seed, he ought to make sure that the crop from which his seed has to be taken had been properly harvested, and the grain carefully stored after being threshed. It will be found that newly-threshed grain germinates more quickly than that which has been threshed and stored in a granary for some time.

Dressing of Grain Selected for Seeds: its Importance.—Errors are often made through want of attention to dressing the grain, and it cannot be too strongly urged upon all who wish to have an evenly-ripening, level crop, whether it be wheat, barley, oats, or any other grain, that an insufficiently dressed sample of seed can never be expected to produce a crop to ripen evenly. Appliances for dressing grain have been brought to great perfection, and more than ordinary care ought to be bestowed upon the cleaning and preparation of the grain intended for seed. Passing the grain, time after time, through the winnowing or dressing-machine ought to remove the light or imperfect grain and ensure a uniform sample. In all well-arranged dressing-machines the grain passes over a screen, or series of screens, through which the small seeds fall, thus separating the grain to be sown from the seeds of many of the most troublesome weeds.

WHEAT.

Wheat deserves to be spoken of as the most valuable and most widely grown of all our cereals.

The average production of wheat per acre in Great Britain is about thirty bushels, each bushel weighing 60 lbs., which means about 16 cwt. of grain per acre. The increasing import of foreign grain has led to a large reduction in the value of wheat, and, in consequence, there has been of late years a considerable contraction in the acreage grown in Britain.

Being a deep-rooted plant, it can be grown in climates where such surface-rooting cereals as barley and oats would be scorched and rendered worthless. Several of our Colonies, and many foreign countries, send us large supplies of wheat grown and ripened under a blazing sun, which would mean destruction to less deep-rooted plants.

"Winter Wheat" and "Spring Wheat."—In Britain wheat is generally sown either in the autumn or in the spring, and thus two kinds are spoken of—"winter wheat" and "spring wheat." Winter wheat is sown in the autumn, and, as a rule, is grown either upon land that has been bare fallowed, *i.e.* lain uncropped during the summer, or land that has been ploughed out of grass, which may have been cut for hay or pastured with cattle or sheep.

Sowing and Harvesting.—Growing wheat after bare fallow is a system which has long been pursued on strong clay soils, and may be described as follows:—After the preceding crop has been harvested, the stubble is ploughed down and the furrows are allowed to lie in an open condition during the winter, exposed to rain and frost till the end of the seed-time in spring. In dry weather the ground is re-ploughed, and again afterwards as often as may be considered necessary during the summer, care being taken to do the ploughing when the land is dry. By thus turning up the soil to the action of the summer sun and air, it becomes dry and hard, and the weeds, both those growing on the surface and the deeply-rooted more troublesome ones, are killed. In the early autumn dung is spread on the surface and ploughed down; and, embracing an opportunity after rain, when the loosely-ploughed surface has again become sufficiently dry, the land is subjected to continued harrowings until it is broken up and in a fit state for the reception of the seed. Much of the success of wheat-growing depends upon the care and attention given to the state of the soil when being worked, and it has been said that this system of wheat-growing can only be properly carried out by people who have had considerable experience of such strong clay soils as are here spoken of.

The expense of growing wheat after a bare fallow, combined with the uncertainty of dry summer weather in which to properly work the fallows, together with the

reduced value of the grain, have led to a system of partial fallowing which, of late years, has been widely adopted. Immediately after the preceding crop has been reaped, the land is ploughed and sown with winter rye, tares, rape, or other "catch-crops." By April, May, or June this crop is well up, and is valuable feeding for ewes and lambs or grazing sheep, which are folded over the field in "breaks," so that the crop may be evenly eaten to the ground. The land is then ploughed and treated during the summer as if it had been a bare fallow, and, being enriched with the manure left by the sheep while the green crop was being eaten off it, is in "good heart," so that the wheat crop starts away full of vigour and strength. The advantages of such a system are at once apparent. The green crop, consumed on the land at a season of the year when even strong clay lands can carry sheep, leaves a rich coating of manure distributed over the surface without the expense of carting, &c., an expense which would have to be incurred if the manure had to be brought from the foldyards or homesteads. The system has also the advantage of checking the growth of all kinds of weeds during the spring, thus to a certain extent cleaning the land and saving the expense of labour.

Wheat after seeds is the general rule in a rotation on lands other than the heavy clays. The "seeds" (grasses and clovers) may have been down one, two, or even more years, but in each case the procedure with respect to preparation is the same. In the autumn, the land which is to be sown with wheat is manured and ploughed six or seven inches deep to ensure the grass being well covered, and in the lighter soils the furrows are often pressed down with a roller to consolidate the soil and make a firm seed-bed. In cases where the land is allowed to lie in grass for more than two years, farmyard manure is often applied to the second year's grass, and if so, no manure is applied for the wheat crop. Where the lea (grass land) has been well planted with clover and grazed by feeding cattle or sheep, only a light covering of manure will probably be found necessary; but this, of course, must depend entirely upon the state of the land, whether it is in good heart or otherwise. When, by repeated harrowings, a good seed-bed has been obtained, two to two and a half bushels of seed per

acre are drilled in about two inches deep, the surface being left rough as a protection for the plants during the winter.

Winter wheat, following potatoes, is a crop much grown in many districts, the land being ploughed immediately after the potato crop is taken off, the seed being drilled in when the weather in late autumn admits of such work.

Spring wheat may follow potatoes, roots, beans, or peas. The land is ploughed during the late autumn or winter; and as early as possible in the spring, when the soil is dry, the surface is well harrowed and the seed is drilled in about two inches deep.

Value of Wheat-Straw.—In our great commercial centres, where business- and pleasure-horses are kept in great numbers, wheat-straw, being largely used as litter, maintains a high price, thereby greatly enhancing the value of the crop. During past years many farmers have netted more for the straw of the wheat crops grown upon their farms than for the grain. But for this, the already curtailed extent of the land under wheat in Great Britain would doubtless have been further reduced.

BARLEY.

Being a surface-feeding plant, with its roots penetrating only a short distance into the soil, barley requires frequent showers during its growth. It may be said to be a "light land" cereal, yet in a favourable season profitable crops are grown on comparatively heavy clay soils.

Qualities required in Malting.—The value of barley depends much upon its malting properties, and high prices are paid by the brewers of high-class pale ales for bright, well-coloured samples. Along with



FIG. 1.
HEAD OR EAR
OF WHEAT.



FIG. 2.
EAR OF BARLEY.

the required colour, the grains of high-class barley should be evenly developed, so that after being steeped and laid out to grow or malt, it may sprout evenly. After malting or sprouting, the grain is put upon a kiln to be dried, and it can be easily understood that in a perfect sample of malt the growths, when thus checked, ought to be of uniform length.

Barley in Crop Rotation.—As has been seen when speaking of rotation of crops, barley, as a rule, follows a root crop, with clovers and grasses (generally termed “seeds”) sown along with it. When, however, land is in a high state of cultivation, clean, and rich in manure, a barley crop is often taken after wheat. No grass seeds are sown in such cases, and consequently the crop can be more quickly saved and the colour of the grain preserved.

Harvest-time.—Barley should not be cut till it is quite ripe—“dead ripe,” it is termed—and only when quite dry. Attention to this is important from two points of view. Being fully ripened, the sample of the grain is uniform, and likely to sprout or malt evenly, and the straw being dry or “dead,” stacking may be quickly carried out, and the risk of spoiling by exposure to the weather in the fields after cutting greatly reduced.

When ground into meal, barley is largely used for feeding purposes, and is especially popular as food for pigs.

The quantity of seed per acre depends much upon the quality of the land and its manurial condition. From two-and-a-half to three bushels per acre is the ordinary “seeding,” and the average returns may be put at thirty-six to forty bushels, weighing 56 lbs. each.

OATS.

Oats are especially suited for a climate where there is a frequently recurring rainfall during the spring and summer months.

As a crop oats are largely cultivated in Scotland, where the more valuable varieties may be said to be produced in their greatest perfection. They are grown most successfully on friable soils of a light texture, and in many of the cold late districts in the North of Scotland heavy crops of high-class grain are grown on such soils. If grown for any length of time on strong clay soils, the plump, short grains of the better-class varieties lose their characteristics, and become lean-shaped, with a longer husk, often ending in a hair, and, in fact, becoming more like the Tartarian oats.

The grain of the oat being enclosed in chaff, it is less liable to injury through rain than wheat or barley, and on this account may be harvested under circumstances which would practically ruin other cereal crops.

Varieties of Oats.—There are two great varieties of oats, known as “Long” and “Short” oats. The form of the ear and the general characteristics of these two varieties may be easily understood by looking at spikes as shown in the drawings, p. 18.

The average crop of oats on well-cultivated land in districts where the grain is the staple crop may be put at five quarters or forty bushels per acre, each bushel weighing 40 to 42 lbs. Six, eight, and even ten quarters per acre are often grown on highly manured soils where the land is good and very well cultivated.

As fodder for stock, oat-straw is extremely valuable; and in oat-growing districts every care is taken to secure it in good condition. As the grain is protected by chaff, this crop may with safety be left longer exposed in the fields than wheat or barley. This being so, the oat crop can be cut “quick,” i.e. before it is fully ripe, and allowed to ripen in the sheaf, so that a certain proportion of the natural sap is retained in the straw, to the increase of its feeding properties.

Oats as Food.—In many districts the farm-horses are fed almost entirely on oat-straw, and when well saved and freshly threshed, oat-straw is a most suitable food for horses



FIG. 3.—HEAD OF SHORT OATS.



FIG. 4.—HEAD OF LONG OATS.

doing slow work. It is hardly necessary to refer to the value of oats as a food for horses, seeing that the use of this grain is almost universal alike in the racing and hunting stables, and, indeed, wherever horses have to undergo hard and long-continued fast work.

When ground, bruised, and mixed with ground linseed or oil-cake, oats make one of our safest cattle foods; ground oats given along with turnips has long been a favourite food with cattlemen, as the animals fed on this diet fatten quickly, and their coats show a brightness and pile which is appreciated by the butchers in the fat markets.

In many districts oatmeal has long been the staple food of the agricultural labourer. In its preparation the grain is kiln-dried, relieved of its husk, and ground to degrees of fineness differing much according to the tastes of the people in the various localities.

In many districts of Great Britain the rural population, until quite recent years, may be said to have lived entirely on oatmeal, vegetables, and milk; and yet it will be freely acknowledged that they were as fine a body of men as could be met with in any country in the world. With them oatmeal is prepared in two ways—as porridge and as “brose” (a dish known in the North of England as “stirabout”), the former being oatmeal boiled in water with a little salt, while in the latter case the meal with a little salt in it is stirred as the boiling water is poured upon it. In either case milk is served with the prepared dish.

However incredible it may seem to a meat-eating community, it is none the less true that thirty years ago the Scotch ploughman in many districts subsisted entirely upon “brose,” and even to-day it forms his staple food.

While oatmeal as a food has of late years been gradually losing its place with the labouring classes in rural districts, where, as we have seen, it was almost universally used, it has become more popular amongst people in a higher position of life. In most of our better-class hotels oatmeal porridge now figures on the breakfast menu-cards; and this is no doubt due to catering for the American tourists, porridge being a most popular breakfast dish in the United States. Be this as it may, oatmeal of late

years has certainly come to be more widely used in better-class houses, with the general approval of the medical faculty. As food for a colonist's family in a new country, oatmeal holds a high place, seeing it is an easily prepared product of one of the hardiest and most widely grown of all our cereals. With oatmeal, new milk, and a few easily cultivated vegetables, numerous dishes may be prepared that are not only palatable and highly nutritious, but also in every way suited for those living an outdoor life.

RYE.

This grain is largely grown in several of the Continental countries, where it forms the principal food of a large number of the population. It may be said to be the hardiest of our cereals, as it will ripen in a climate unsuited for wheat, barley, or even oats; while, owing to the formation of the head or ear, it is less liable than other cereals to shed or lose the grain during wind-storms.

Sown on a poor, sandy soil, rye produces a great weight of straw and grain, the straw being especially valuable for thatching purposes, mattress-stuffing, and the like. In many poor soils rye is grown for feeding purposes, and, if well boiled and given with care, it is, no doubt, a valuable food for farm stock.

As a forage plant it is largely grown, sometimes by itself, and often in conjunction with vetches, peas, &c. Sown in the autumn, and being able to withstand the severe weather in winter, it affords an early food for sheep in the spring months, or, if left till early summer, it produces a great weight of green food, which may be cut and carried to animals in the yards and feeding-boxes. Being strong in its straw, it affords a reliable stake or support to clinging plants, such as vetches and peas grown as forage plants.

A bushel of rye weighs about 60 lbs., and the average crop, as grown upon light land, may be put at twenty-four to thirty bushels per acre.

ROOT CROPS.

POTATOES.

The potato crop forms one of the most common and useful of our farm crops; it is cultivated on all sorts of soils, and in almost all climates. As grown in Great Britain, this crop takes the place of a fallow, and, as a rule, follows a grain crop. On light sandy soils potatoes are often grown after grass, the partially decayed sod of the grass being useful in retaining the moisture in such soils, and affording food for the plants. The better qualities of potatoes are grown upon dry, friable soils, and the planting, keeping clean, and gathering the crop on such soils is much less expensive than on strong clay lands.

Potatoes may be said to form the staple food of the poorer population of Ireland, by whom they are extensively grown on peaty soils, where the cultivation of the land is often of a rude description.

The Potato Disease.—There are a great many varieties of potatoes, and every year new kinds are being brought out through cross-fertilisation and the propagation of the plants from the seeds contained in the “plums,” or fruit, of the plants. A number of these newer varieties seem, for a time, to be disease-resisting, and many large growers of potatoes depend more upon strong-growing new varieties to ward off the attack of the fungus which is the cause of the crop-destroying blight known as “potato disease,” than on the effects of any specific treatment applied to the plants. The potato disease appears in summer, when the stems and leaves are in full growth, mild damp weather being especially favourable for its development. The first indication of its presence are small, brown-coloured, round spots on the leaves, indicating the total destruction of that portion of the leaf-surface on which the fungus has taken root. On well-cultivated dry soils free from weeds, bright dry weather often destroys the fungus life, and the tubers may suffer little, even in cases where, during a few close, mild, damp days, the fungus growth had evidently taken an extensive hold. After the appearance of the leaf-spots, should the weather continue wet, or the presence of weeds prevent

the drying action of a bright atmosphere, the disease quickly develops itself on the tubers, to the great destruction of the crop.

"Spraying" as a Remedy.—In Ireland, where less attention is given to secure new and disease-resisting varieties, "spraying" the growing plants during the early summer with a mixture of sulphate of copper and lime has been proved, beyond doubt, to be useful in warding off the disease. The materials sufficient for spraying an acre of potatoes are :—

20 lbs. copper sulphate (98 per cent. purity).
12 lbs. limeshell, newly burned, or 18 lbs. newly slacked lime.
100 gallons clear water.

In ordinary practice it will generally be more convenient to prepare the mixture in smaller quantities than that needed for an acre.

Suppose, therefore, that a mixture sufficient for one-fourth of an acre is to be prepared, 5 lbs. of copper sulphate, in a piece of coarse sacking, should be suspended in a wooden vessel containing 20 gallons of pure water till it is entirely dissolved. Stirring the liquid occasionally will hasten the dissolving process.

Four or 5 lbs. of lime newly slacked, or 3 lbs. of unslacked limeshell, should be put into another vessel containing sufficient water to moisten the lime thoroughly, adding afterwards 5 gallons of clean water, and stirring till the whole is properly mixed.

When all the copper sulphate has been dissolved and the lime well mixed, the two liquids should be put together and stirred for at least five minutes. The mixture, which should appear azure blue in colour if the copper sulphate is pure, should now be allowed to rest for five minutes, when it ought to appear perfectly clear for a few inches in depth. If, instead of appearing clear to the depth mentioned, the liquid is slightly tinged with blue, a little more lime is needed.

The copper sulphate may be left in solution for a considerable time, but the milk of lime should be freshly made and added to the other solution immediately before the mixture is to be used.

The Planting of Potatoes—Drills *versus* "Lazybeds."—Potatoes, as a rule, are grown in drills or rows, but in the

West of Ireland, where the land is undrained, potatoes are largely grown in what are termed "lazybeds"; these beds being about 4 feet wide, with a deep trench between each to carry off the surface water, and to some extent answer the purpose of thorough drains on better cultivated soils.

Advocates of the "lazybed" system claim that a more evenly sized sample of tubers is grown in "lazybeds" than in raised drills, where the tubers grow and mature under a less uniform depth of soil. Doubtless there is a certain amount of weight to be attached to this when the entire crop is meant to be consumed at home, and when medium-sized potatoes are preferred to a mixed crop composed of large and small ones.

Granted, however, that the advocates of the "lazybed" system may have some good reason to advance for their belief of its suitability under certain circumstances, it cannot be denied that, under the raised drill method of cultivation, the land can be kept comparatively free of weeds by mechanical means, whereas in "lazybeds" hand-weeding must of necessity be resorted to.

Potato drills are thrown up about 28 to 30 inches in width, and the seeds, or sets, generally the smaller-sized tubers, are planted from about 12 to 15 inches apart. About 12 cwt. of the smaller-sized potatoes are sufficient to plant an acre, while the average yield on suitable soils of medium quality may be put at 5 tons.

Seed Potatoes.—Large-sized potatoes are often used for seed, being cut up into two or three pieces, care being taken that each portion has at least one "eye" or growth-bud.

The Storing of Potatoes.—Unless in countries where the winter frosts are intense, potatoes are stored in "pits" or "pies" in some convenient situation near the farm buildings or in the field near a road. The process of storing is a very simple one. A site with a dry bottom being fixed upon, the surface is levelled and the potatoes, as emptied from the carts, are piled up in a prism-shaped heap, having a base about three feet wide; to be covered to the depth of about two inches with straw, and a slight coating of earth. After about a week, when the fermentation that arises from the potatoes being put together has ceased, earth, dug from the outsides of the heaps, is evenly spread over the pies to the depth of ten to twelve

inches, a covering which is considered sufficient to protect the potatoes from the frost; the trenches dug out to supply the earth-covering form drains round the pies.

In harvesting the crop, when a large breadth is grown, potato-diggers drawn by horses, or the potato-ploughs, are used. These raise the tubers and leave them spread on the surface, to be gathered by hand and carted off. In many cases an ordinary plough is used to turn up the drills, when the exposed potatoes may be gathered into carts, and the land afterwards forked over, harrowed, and further picked.

TURNIPS.

Some idea of the importance of the turnip crop may be gathered from the fact that under the ordinary four, five, or six-course rotation, as carried out over a wide extent of country, a fourth, fifth, or sixth of the entire extent of arable land is each year devoted to its cultivation. It is often spoken of as an expensive crop, but as it takes the place and answers the purpose of a bare fallow in cleaning the land, a portion of the labour bill and cost of manures charged against it might in all fairness be distributed over and charged to other crops forming the rotation.

A friable, light soil is best suited for the successful growth of turnips. On heavy clays it is almost impossible, in ordinary seasons, to secure the surface preparation necessary for the growth of the young plants. Being tender in the early stages of their growth, the turnip plants require a fine surface tilth, and this is easily obtained on sandy, friable, or light soils.

Common Varieties.—There are two great varieties of turnips, viz., the Swede and the Common or Soft turnip, and on many farms the proportion grown of each depends upon the live-stock kept and the quality of soil available for the crop. Swedes mature more slowly and require richer soil than the common turnips, but as they are more valuable for feeding purposes, and, when stored, can be relied upon to retain their valuable properties into spring, and even early summer, they are largely grown. Many dairymen prefer common turnips to swedes as food for cows, and, on farms where a regular breeding and feeding stock of cattle is kept, the cows and young cattle are

largely fed on common turnips. On light soils a system is pursued which is not only advantageous to the land, but, as it is a labour-saving one, is justly popular. A proportion amounting to an eighth, a sixth, a fourth, or even a half of the turnip crop is eaten on the land by sheep. The ordinary practice pursued on farms where the land is in good condition is to cart to the homesteads three-fourths of the turnip crop to be consumed by cattle, and to leave one-fourth to be eaten by sheep. In cases where the land is in poor condition, a larger proportion is left for sheep, and as the crop, as a rule, is grown in drills or rows, the proportion left to that carted off is easily determined; the sheep eating off the softer varieties in the autumn and the swedes during the winter and spring months.

Protection against Frost.—As both swedes and common turnips suffer from frost, it is necessary either to protect them in some way, or to store them in the late autumn. Common turnips are more liable to suffer than swedes, and in those districts where they are largely grown care is taken to propagate varieties that grow well into the soil and produce a thick covering of leaves. With such varieties, a careful earthing-up, by passing the double mould-board plough between the drills in autumn, is by many considered a sufficient safeguard against frost. If this work is well done, the roots retain their sap well into spring. Swedes, growing farther out of the soil, are more difficult to protect in this way, and, as a rule, they are pulled, and either stored on the field, or are carted into heaps and covered with straw in the stackyards or spare corners near the farm buildings.

One of the most simple and effective methods of storing turnips in the fields is to build up the roots into small cone-shaped heaps, after they have been topped and tailed, covering them with earth to the depth of 2 or 3 inches.

In Canada and many of the American States, turnips have to be stored in buildings, as the intense frost often experienced would entirely destroy the roots left out in the field or protected in any of the ordinary systems pursued in Britain.

The quantity of seed necessary for sowing an acre in rows or drills 24 to 26 inches apart may be put at 3 lbs., and the weight of an average crop at twenty tons per acre.

MANGEL-WURZEL.

Mangels are largely grown on strong clay soils, where the early summer rainfall is small and the summer temperature high. In Britain, the total acreage of land north of the Humber under this crop is comparatively small, while South-country farmers depend much upon mangels as a spring and early summer food for farm stock.

Enormous weights of mangels are grown under favourable circumstances, and we often hear of fifty to sixty tons per acre being produced on exceptionally well-manured, good soils. The average crop, however, may be put at twenty tons per acre.

As the mangel seed is covered with a thick tough skin, it takes a considerable time to germinate, and consequently must be sown earlier than turnips. From 5 to 7 lbs. may be put as the quantity of seed sown per acre, either drilled in on the flat, or on raised rows from 2 feet to 2 feet 6 inches apart. After the plants have become well established, say about 2 inches high, singling out takes place, the plants being left at intervals of 10 to 16 inches, according to the condition of the soil, the variety grown, and other circumstances likely to regulate the size of the bulbs when at full growth.

Precautions in Storing.—Mangels ought to be stored before the winter sets in, as they are very liable to be destroyed by frosts, and in pulling and cleaning, much care is necessary in topping and tailing to avoid cutting into the roots. A root losing its juice through being cut soon begins to rot, and in doing so sets up fermentation, to the detriment of the whole heap.

CABBAGE.

While in some parts of the country the cabbage is only grown as a table vegetable, in others it figures largely as an important forage plant on stock farms. In the former case, a small-sized variety with leaves of a fine texture is grown, while to secure a large weight of crop, stronger and rougher-leaved sorts are preferred in the cultivation of the field cabbage. For either purpose, the cultivation is very much alike; the seed is thickly sown on a well-prepared bed, and, when the plants are about 3 inches high, they are

transplanted and set in rows, the rougher varieties of course being set wider apart than the finer sorts.

If care be taken that the transplanting is done when the soil is damp, the young plants will start away at once, and, beyond keeping the land free from weeds, no particular attention is necessary in their cultivation. Cabbages are largely grown on strong clay soils, where it is often difficult to prepare the surface sufficiently fine to suit swedes or turnips. Field cabbages are planted in lines or rows, from 24 to 30 inches apart, and the plants set at intervals of about 18 inches.

PASTURE GRASSES.

The value attached to old pastures in many parts of England may be estimated by the careful way in which farm leases and agreements are drawn up, so as to prevent tenants from breaking up old grass for cropping purposes. As a rule, a penalty at the rate of £50 an acre is stipulated as the amount of fine to be payable in the event of ploughing or breaking up old grass. On many soils, more especially those of a clay nature, under ordinary circumstances, it takes many years to get a good sod established, and in consequence owners of grass land are naturally careful to protect it from being broken up.

How to Form Permanent Pastures—Preparation and Mixtures of Grasses.—Before laying land down to permanent pastures, it is of the utmost importance to have it cleared of deep-rooted and surface weeds, since many of the most valuable perennial grasses in their early stages of growth are tender, and easily choked and destroyed. The mixture of seeds sown for permanent pastures varies much according to the nature of the soil and climate, but the following mixture, sufficient for an acre, may be put as a popular one in many districts:—

	Lbs.
Perennial rye-grass	10
Cocksfoot	5
Meadow fescue	4
Foxtail	3
Sweet vernal	1
Timothy	3
Cow-grass	3
White clover	3
Alsike clover	1
Trefoil	1

These seeds, many of them small, should be sown on a well-prepared surface, so that they may not be too deeply buried when lightly harrowed in; and special care ought to be taken that the grain crop with which they are sown down is thinly planted, so that, while affording shelter for the young grasses, it may at the same time allow the breathing space necessary for the undergrowing crop.

The grasses sown in an arable land rotation vary according to the nature of the soil and the number of years the land is intended to be left in grass. For one year's grass the mixture per acre may be put as follows:—

	Lbs.
Italian rye-grass	15
English red clover	8
White clover	1
Alsike clover	1
Trefoil	1

For two years' grass:—

	Lbs.
Perennial rye-grass	12
Italian rye-grass	8
Cocksfoot	3
Timothy	3
English red clover	4
Cow-grass	2
White clover	2
Alsike clover	1
Trefoil	1

For three or more years' grass:—

	Lbs.
Perennial rye-grass	18
Italian rye-grass	4
Cocksfoot	5
Timothy	2
English red clover	2
Cow-grass	4
White clover	2
Alsike clover	1
Trefoil	1

CHAPTER IV

VEGETABLES AND FRUITS

THE GARDEN :—Its position, shelter, and drainage. VEGETABLES :—Cabbage—Kail and cauliflower—Early potatoes and turnips—Peas—Carrots—Parsnips—Leeks and onions—Other vegetables—Rhubarb. SMALL FRUIT :—Currants and gooseberries—Raspberries—Strawberries. FRUIT TREES :—Apples and other fruit-bearing trees—List of varieties most suitable for a farmer's garden.

VEGETABLES.

WITH proper management the farmer's garden can be made to produce a large amount of wholesome food that will be much appreciated by his household. Before, however, success in the production of vegetables can be looked for, it is absolutely necessary that the garden be properly fenced, and, if possible, sheltered from the prevailing winds.

The situation, soil, and climate will, of course, regulate the varieties of vegetables to be grown, but a number of the most useful are hardy, and, with proper attention, will grow well under many varied circumstances.

In laying out a garden, it is all-important that the land be thoroughly drained, deeply dug, and the surface made as level as possible. Under proper management a succession of crops may be grown, so that during the spring, summer, and autumn the whole of the vegetable garden will be continually in crop, while during winter a portion of it ought to be filled with plants to come to maturity in late spring or early summer.

CABBAGE.

Cabbage is one of the most useful and hardy vegetables, seeing that it can be grown on well-manured soil so as to be available at all seasons of the year. The seed of Enfield or Early York cabbage, sown in a bed in August

or early in September, will produce plants strong enough to be planted out in October or the beginning of November. For setting out in autumn the stronger plants should be selected and the weaker ones left in the bed for spring planting. Those planted out in the autumn may be expected to be ready for use by June; they will not be what is termed fully "hearted," but sufficiently forward to be greatly relished at a season of the year when few vegetable are available. Immediately these early cabbages are cut, the land may be dug and planted with lettuce, beet, leeks, or late peas.

Those plants left in the "nursery" bed may be planted out in the spring, to follow as a second crop; those cut early being used as early autumn vegetables, and the others left to fully "heart" or mature. In cutting early cabbages before they become hearted, a system is often pursued which has much to commend it: the stem is cut right across just below the leaves, and two + shaped cuts are made with a knife on the top of the standing stem. After a short time, a sprout appears from each of the four sections; these grow into small heads, delicate in texture and much appreciated as a table vegetable.

KAIL.

Kail, or what is often spoken of as "Curly Kail," should be sown in the beds in autumn, and planted out in the spring to be ready for use in the autumn or winter. The same system of management holds good with the Savoy and other hardy useful vegetables, while Cauliflower plants require protection from the winter frosts, either by a covering of straw or by being under glass. Sown in early summer, cauliflower plants come quickly to a planting-out stage, and are available for use in autumn.

EARLY POTATOES.

There are many varieties of early potatoes, each having their advocates; but in the matter of having potatoes fit for use early in the season, it may be said that more depends upon the care exercised in the management than on the selection of any particular variety. Although otherwise a

hardy plant, the potato in its early stages of growth is very subject to be destroyed by spring frosts, and in consequence the plants should not appear above ground so long as these are likely to occur, unless care be taken to cover up the young plants every night till the season of frosts is past. The following system here described can be carried out at a small expense, and is, to a considerable extent, a safeguard against any damage through spring frosts. The potato seeds are, in the early spring, placed in shallow boxes, which are kept in cowhouses or other buildings where the temperature is higher than out of doors: this causes the seeds to start and throw out growths earlier than they would have done in an outside pit or store. These growths can be hastened or retarded as the planting season comes round, by either placing the seed-boxes in a higher temperature or removing them to a cooler situation. When the growths are about two inches long, the seeds are carefully placed in the ground and covered with soil, to take root and provide sustenance for the young shoots, already well advanced. A small amount of covering will protect the young potato plants from damage by frosts, and many farmers who aim at growing early potatoes in their gardens spread a light covering of straw over the plants at night till the season of frosts is past.

EARLY TURNIPS.

Turnips may be sown early in April, and as they can stand through the spring frosts, after they have got their second or rough blades, protection by straw covering at night need only extend over a short period. A second and third sowing of garden turnips should be put in, so that a continuous crop may be gathered throughout the summer and autumn.

PEAS.

There are many varieties of peas, but those best suited for a farmer's garden are of the semi-dwarf varieties. If sown in the early spring, and at intervals of two or three weeks until the month of June, a continued supply of green peas may be gathered throughout the whole summer and autumn.

CARROTS AND PARSNIPS.

These two vegetables ought, if possible, to be grown on deep soil, where the tap-root of good specimens will be found to reach down 12 to 18 inches below the surface. The seeds should be sown in lines about 10 inches apart, so as to allow the free use of a six-inch hoe in keeping down the weeds during the summer. Any time after the middle of March, when the land is dry, the seeds may be put in about half an inch below the surface, and when the plants are about two inches high they should be thinned out. The nature of the soil, and the size the roots are expected to attain, ought to regulate the distance left between each plant, which may vary from two to six inches.

In the autumn, when the leaves fall, the roots should be dug up in dry weather and stored for winter use. If they can be stored in a building, they keep well in a heap thickly covered with dry sand or peat; but in ordinary practice they are stored in conical heaps, or pies, in the garden, with a slight covering of straw and six to nine inches of soil.

LEEKS.

These are grown in rows, much in the same way as carrots; the stronger plants that are thinned ought to be replanted four to six inches distant from one another and arranged in lines. These lines are formed 20 inches apart, so as to allow of the plants being earthed up and blanched in the late summer and autumn.

ONIONS.

Onions are perhaps the most widely grown and universally used of all the common garden vegetables. The seed is sown either in the autumn or spring, the larger varieties being sown in August or September. These come to maturity the following autumn, and, under favourable circumstances, often obtain a circumference of nine to ten inches. The seeds of the smaller varieties are sown in rows during March or April, as the condition of the land will admit, and should be very lightly covered with fine soil. Onions are often sown broadcast in beds, but in

these the weeds can only be kept down by hand-weeding, whereas, if grown in rows or lines, the hoe is available, and its action serves the double purpose of clearing the land of weeds and stirring it so that the plants may benefit by the action of the sun and air.

VARIOUS OTHER VEGETABLES.

Many other useful and easily grown vegetables, such as Lettuce, Radish, Cress, Beans, Spinach, Parsley, &c., ought to have a place in every farmer's garden, and in every one a corner ought to be set apart for Rhubarb. This plant is propagated from roots, and should be planted in deep, well-manured soil. If early rhubarb is aimed at, the plants ought to be covered up in the autumn with rough stable manure; this becomes washed during the winter, and in spring forms a light, straw shelter, through which the stalks grow up protected from the spring frosts. A few well-selected rhubarb roots planted in good, well-manured soil will produce a great weight of stalks, which can be cooked in many ways, or preserved in sugar to serve a purpose similar to that of preserved fruits.

SMALL FRUIT.

CURRANTS AND GOOSEBERRIES.

Along with vegetables, a farmer's garden ought to produce many varieties of fruit. If planted along the garden walls, the different kinds of currants can be grown, and, with a little care, may be so trained as to form a pretty covering to the garden fence, whether it be of stone, brick, or wood.

White and Red Currants trained on walls require an exposure facing the south or west, while Black Currants do well on those facing east or north. In many cases currants are grown like gooseberries on carefully pruned, bush-shaped trees. These are generally planted on the borders of walks, and afford shelter for the young and tender vegetables grown in rows or beds in the plots divided by the walks. Currant and gooseberry plants are

propagated from cuttings, and can be grown in any farmer's garden. Slips of young wood, about twelve inches long, are set in shallow trenches in the autumn, about six inches apart, with the small ends standing about six inches above the ground. In the spring they throw out shoots, and, beyond being kept clear of weeds, they require no further attention till the autumn, when they may be transplanted into the space they are each meant to occupy.

Attention to the pruning of the plant during the first years of its growth is all-important, as the shape of a tree depends entirely upon the care bestowed upon it during the first few years of its growth.

RASPBERRIES.

Unlike currants, Raspberries are propagated from divided roots of established plants, and the young cane-wood on which the fruit is grown dies down after having produced one crop. Raspberries require less sun than white or red currants, and may be planted in a shady corner with a north or east exposure. A stake should be driven into the soil alongside each root, and the tender fruit-bearing canes ought to be carefully tied up, so as to prevent their being broken down or damaged by wind-storms.

STRAWBERRIES.

The Strawberry may be said to be the most widely popular, and is certainly one of the most luscious, of our garden fruits, and, being hardy and easily cultivated, it ought to have a place in every farmer's garden. It is propagated from runners thrown out by established plants; these take root alongside the parent plants in the early summer, are fit to be transplanted in the early autumn, and begin to bear fruit the following summer. In many gardens, strawberries are planted along the edge of the walks, and take the place of boxwood or other edging plants. To ensure a full crop, the soil should be well manured and the plants renewed every few years.

FRUIT TREES.

Although perhaps the more hardy fruit trees ought to be grown in orchards, it will be found that many spaces in a farmer's garden are not only available, but well suited, for the profitable cultivation of apples, plums, damsons, cherries, pears, and apricots. All these trees may be trained on the walls or fences surrounding the garden, or they may alternate with gooseberry or currant bushes, as small standard trees, along the borders. It is almost unnecessary to say that they ought not to be planted where the soil has to be dug more than two or three inches deep. The root-lets, from which the tree draws its principal support, are thrown out in search of food a short distance under the surface, and ought not to be cut or destroyed. If these are cut, the tree is driven to depend upon its tap-root growing in the subsoil, and, although with such support it may make wood freely, it will seldom bear a full crop of fruit.

APPLES.

Great advances have been made of late years in the selection and cultivation of apple-trees, many seedsmen and nurserymen making a specialty of the business by propagating and growing varieties suitable for different soils, climates, and purposes. The process of grafting a branch or shoot of a fruit-bearing plant to the stem of another tree has long been understood. Latterly, careful observers, by proper selection of the trees made use of as foster-parents, have been able to produce fruit-bearing trees adapted for many situations which were at one time looked upon as unsuited for the growth of fruit.

Many of the dwarf varieties of apple-trees are admirably suited as border plants in a vegetable garden, and indeed in every respect they will be found, for the space occupied, more profitable than the larger standard trees. The same holds good with plum, cherry, and pear trees, the fruit being easily gathered, the pruning likely to be more carefully attended to, and the risk of damage to the fruit through wind-storms largely reduced. As has been said, all these trees may be, and often are, trained on walls or

fences, and few objects in a garden indicate more clearly the want of proper care than do carelessly grown, badly trained wall-trees.

Apricot-trees should be trained on walls facing the south, and ought to be pruned with great care.

The following are a few of the different kinds of fruit-trees most suitable for a farmer's garden :—

COOKING APPLES.

For summer use	Lord Grosvenor. Keswick Codlin. Duchess of Oldenburg.
For autumn use	Stirling Castle. Ecklinville. Potts' Seedling.
For winter use	Beauty of Kent. Winter Hawthornden. Small's Admirable.
For spring use	Bramley's Seedling. New Northern Greening. Lane's Prince Albert.

DESSERT APPLES.

For summer use	Red Juneating. Devonshire Quarrenden.
For autumn use	Worcester Pearmain. Kerry Pippin. Yellow Ingestrie.
For winter use	Cox's Orange Pippin. King of Pippins. Claygate Pearmain.
For spring use	Braddick's Nonpareil. Rosemary Russet. Allen's Everlasting.

PEARS.

Standard Trees.

Jargonelle.
Beacon.
Hessle.

Bushes or Walls.

For early use	Citron des Carmes. Clapp's Favourite. Louise Bonne of Jersey.
For later use	Glou Morceau. Josephine de Malines. Bergamotte Esperen.

PLUMS.

For cooking or preserving	Victoria. River's Early Prolific. Czar.
For dessert	Green Gage. Transparent Gage. Coe's Golden Drop.

DAMSONS.

Farleigh.
Prune.
Bradley's King.

CHERRIES.

Early Rivers.
Elton.
Governor Wood.

APRICOTS.

Early Moorpark.
Hemskirk.

CHAPTER V

CATTLE AND CATTLE-BREEDING

CATTLE AND CATTLE-BREEDING :—Shorthorns—Hereford cattle—Aberdeen Angus cattle—Devon cattle—Sussex cattle—Galloway cattle—Highland cattle. **DAIRY BREEDS** :—Red polled—Ayrshire cattle—Jersey cattle—Guernsey cattle—Kerry cattle—Dexter cattle. **CROSS-BRED CATTLE** :—“Scrubs” and “Grades”—Prime Scots. **CATTLE REARING AND FEEDING** :—Production of high-class beef—The Scotch system—Yard-feeding—Pasture-feeding—Working oxen—Weighing of cattle.

IN connection with cattle and cattle-breeding, there is no intention to devote space to a consideration of the origin or growth of breeds; such details, however interesting they might be to a farming student, must be left to the many reliable works devoted solely to such subjects. While touching upon a few of the leading points bearing upon the characteristics of the different breeds spoken of, reproductions from photographs of representative specimen animals will be introduced and depended upon as a means of assisting the student to distinguish the different breeds, and to form an opinion regarding their several points and merits.

Seeing, however, that one breed of cattle produced in Britain has, through its influence, in a direct or indirect way, done much to improve the cattle of this and many other countries, it is felt that a short reference to the origin and methods pursued in the breeding of Shorthorns may not be out of place in these pages.

SHORTHORNS.

Much has been written regarding this breed, and yet there is a great amount of uncertainty as to the system pursued or the materials made use of by those early improvers who are now spoken of as being “the fathers of the breed.” We know that a superior breed of cattle had



FIG. 5.—SHORTHORN BULL ("Booth" and "Crnickshank" Mixture), "COUNT LAVENDER" (60,545).

Bred by William Duthie, Collynie, Tarves, N.B. The property of J. Deane Willis, Bapton Manor, Codford, Wilts. Winner of forty-two first and twenty-five champion prizes from 1890 to 1896, and sire of a large number of prize-winning animals. (From the "Live-Stock Journal.")

long been maintained in the valley of the Tees; these cattle were spoken of as "Teeswaters" or "Durhams." We also know that several breeders in North Yorkshire and South Durham, towards the end of the last century, profiting by the experience of Bakewell in his efforts to improve the long-horned breed, set to work to improve the Teeswaters by selection and close breeding.

Prominent among the breeders spoken of were the brothers Colling; and indeed almost to them alone may be accorded the credit of producing the breed which has become known as the "Improved Shorthorns." Some writers affirm that the whole of the improvement effected by the Collings was the result of judgment in selection, combined with the following out of Bakewell's method of "in-and-in" breeding. Others maintain that they profited by an infusion of Galloway blood in reducing the size and altering the character of the large-framed Teeswater cattle. Be this as it may, there can be no question regarding the superiority of the cattle produced by them.

This was universally acknowledged; and when the herds were sold in the second decade of the present century, the prices made by the cattle commanded the attention of cattle-breeders throughout the world, and led to herds being formed in many of the English and Scotch counties.

Stimulated by the result of the sales of the Collings' herds, a number of breeders in the same neighbourhood devoted much attention to the improvement of their cattle, those tracing to the Collings' stocks being considered as especially valuable. Foremost among these early breeders may be placed the brothers Booth and Thomas Bates; and so famous did their herds become, that, after a time, the Shorthorn breeders became divided into two great sections, namely, breeders of "Bates" cattle and breeders of "Booth" cattle.

Soon after the sale of the Collings' herd, the first volume of the *Shorthorn Herd Book* was published. Then followed the institution of the Royal Agricultural Society of England and its great annual shows of cattle, and, through prizes won at its earlier meetings, the fame of the Booth and Bates Shorthorns became world-wide. Amongst other foreign buyers, those from the United



FIG. 6.—SHORTHORN BULL ("Cruickshank" upon a "Bates" Foundation), "JUDGE OF ASSIZE" (59,863). Bred by Amos Cruickshank, Sittlyton, Aberdeen. The property of H. Theodore Cookson, Sturford Mead, Wilts. Winner of prizes at the "Royal," Bath, and "West," and other Shows.

States expended money freely in becoming owners of prize-winning specimens of pedigree Shorthorns. Possessed of the national disposition to form "corners" and "rings," the Americans endeavoured to become sole possessors of the Bates cattle of Great Britain, more especially those belonging to one family of them known as the "Duchess" tribe. Having gained possession of the majority of this family, they set to work to impress the world with the idea that in the Duchess family they had a strain of blood superior to that of any other. So well did they succeed, that not only in America did these cattle become extremely valuable, but our breeders at home followed suit, and expended large sums of money in becoming owners of herds descended directly from cattle at one time owned by Thomas Bates.

While the Americans were "rushing up" the value of cattle belonging to the Bates strain of blood, cattle of the Booth blood were being awarded the majority of the prizes offered for Shorthorns at our great agricultural shows. The showyard successes of the Booth cattle, combined with the great prices paid for Bates blood, naturally drew attention to the breed generally, and it is not too much to say that in the course of thirty years from the date of the sale of the Collings' cattle, herds of Shorthorns were formed in almost every county of Great Britain and Ireland.

As has been said, almost the whole breed had become divided into two great sections, and thousands of pounds were paid for individual specimens of both lines of blood.

It is now freely acknowledged that the interests of the breed suffered much during the period from 1860 to 1880, when prices ran high, and when it was held to be of more consequence that a pedigree could be traced, in a so-called direct line, to the foundation-stock belonging to either of the two strains of blood, than that the animal bearing such a pedigree should show superior qualifications. As can be easily imagined, this system naturally led to the production of a class of cattle unsuitable as ordinary stock in the hands of rent-paying farmers.

While almost to a man the Shorthorn breeders of Britain became owners of either Bates or Booth Shorthorns, a breeder in the North of Scotland, Mr. Amos Cruickshank,



FIG. 7.—SHORTHORN HEIFER ("Cruickshank," "Booth," and "Bates" Mixture), "SEA GEM" (H.B. vol. xlii. p. 372). Bred by and the property of Captain W. H. O. Duncombe, Waresley Park, Sandy. Champion female Shorthorn, and winner of the silver cup as the best Shorthorn animal at the "Royal Show" at Manchester in 1897.

pursued an independent and, what has since proved to be, a more sensible method of breeding. Having selected such animals as suited his purpose from both strains before they were so widely separated in character as they ultimately became, he succeeded by careful breeding in maintaining the milk- and beef-producing qualifications which may be said to belong in a special degree to Shorthorns as a breed.

The importance of the work carried out by the late Amos Cruickshank can scarcely be over-estimated. He had a firm belief in pedigree, his estimate of it being based upon the qualifications of the different animals forming its component parts, rather than the blood-relationship these might have to either of the two fashionable lines of Shorthorn blood. Indeed, if the pedigrees of his animals are examined, it will be seen that his herd was originally formed by a combination of Bates, Booth, and several old-established strains of blood highly valued in the earlier days of the breed.

For many years before his herd was broken up in 1889, a large proportion of the bulls bred in it had been exported to Canada and the United States, where they were highly appreciated by breeders who had suffered from the evil effects of the system pursued by keen partisans of Bates blood. In the United States they became known as "Cruickshank" Shorthorns, and the success attending the use of these bulls in overbred Bates herds led to an entire revolution in the system of cattle-breeding in that country. About the same time as the Americans were annually importing the Cruickshank bulls, the larger proportion of the prizes in the Shorthorn classes at the great Smithfield shows was being awarded to cattle tracing directly or indirectly to Cruickshank blood. This naturally directed the attention of English breeders to the value and excellence of the cattle, and during the past eight or ten years this blood has found its way into almost every herd in the United Kingdom, till, at the Royal Show at Manchester in 1897, sixty-three out of seventy-four animals mentioned by the judges had more or less of "Cruickshank" blood in their veins.

With regard to the characteristics of the Shorthorns, it can be confidently said that one of the most important is

their proved adaptability to almost all soils and climates. As early maturing beef animals they have no equal, while as all-round dairy cattle the Shorthorn cows particularly excel. These qualifications, together with the prepotent powers of the Shorthorn bulls, have earned for the breed the title of "The Universal Improver," and much of the greatly increased value of the colonial and foreign cattle now being imported into Britain is doubtless due to the Shorthorn blood in their veins.

A two-year-old steer of this breed may be put to weigh 7 cwts. carcase weight.

The acknowledged colours of the breed are red, red and white, white, and roan.

HEREFORD CATTLE.

This breed of cattle has in England spread very little from its home in Hereford and the few adjoining counties. Nevertheless, while this is the case here, it is held in high estimation in the United States of America and several of our Colonies. Herefords seem to be peculiarly adapted for an outdoor grazing life, in distinction to one where house-feeding is pursued, and it may be inferred that this qualification accounts for their popularity with the ranchmen and stockowners in America and Australia. As a beef breed they are much in favour with butchers, and it will be seen in the report of the London markets, week by week, that Herefords are quoted higher than Shorthorns. To accept these market quotations, however, as a proof of the superiority of the Hereford over the Shorthorn as a beef animal would be somewhat misleading, as these quotations include, under the term Shorthorns, every roan, white, and red and white nondescript with horns. It must also be borne in mind that the market quotations, given in pounds or stones, include the value of the offal, of which the hide forms no mean portion. The value per pound of a hide being regulated by its weight, the fact that the heavy hide of the Hereford commands a higher price per pound than the lighter one belonging to many of our early maturing, quicker-feeding breeds of cattle, adds to the nominal value of Hereford beef as given in the weekly quotations.

It is worthy of note that many of the most famous

breeders of Hereford cattle have pursued a system more in accord with that carried out by owners of thoroughbred horses than has been common with cattle-breeders. In the breeding of Hereford cattle, the produce of showyard prize-winning sires has been highly valued, just as in the racing world the value of an animal depends much upon the turf record of the sire. In this there is much to be commended, as, apart from the importance of the well-established law of "like begetting like," a course of training necessary to ensure showyard honours for a bull may be said to be quite as severe a test of constitution as that undergone by a Derby winner.

The Hereford has of late years become popular as a crossing animal in several districts at home and abroad, and the production of strong-constituted stock has been the result of the use of Hereford bulls in herds where highly-bred Shorthorns had long been relied upon. That the animals the result of the cross should be stronger and better suited for feeding purposes than the progeny of what may be justly termed over-bred Shorthorns, can easily be understood; but this can in no sense be considered a test of comparative value of the two breeds for grading up or crossing purposes. The ordinary farmer had benefited much through the introduction of Shorthorn blood before the breed had passed from the practically useful to the theoretically fashionable stage of its existence. Breeding Shorthorns, however, for fashion or fancy, not only led to the loss of milk and constitution, but to decreased values of store stock; and it can easily be understood that an infusion of fresh blood brought in by any improved breed must necessarily have resulted in the production of a class of animals better suited to the wants of the grazier and butcher. While this is so, there is in too many cases a tendency to place the whole of the improvement to the credit of the breed which may have been used to bring in the cross, and to forget that both parents must necessarily have claims to whatever improvement may have taken place.



FIG. 8.—HEREFORD COW, "TRUTHFUL" (H. B. vol. xxvi. p. 158). Bred by and the property of Her Majesty the Queen, Windsor.
Winner of first prize at the "Royal Show," 1897.

ABERDEEN ANGUS.

From their native district in the east and north-east of Scotland, the Aberdeen Angus cattle have spread throughout Britain, while in the United States they are now one of the most popular breeds. The position this breed has taken at the great fat shows during the past twenty years has naturally drawn the attention of cattle owners to their great fattening, early maturing capabilities.

Along with their valuable feeding qualifications, the breed possesses a wealth of fine-grained lean flesh, which has earned for the Aberdeen Angus beef the proud position of being placed at the top of the list of price quotations in the meat market in London.

Like the Galloway, these cattle are black and hornless, and, when used for crossing purposes, the bulls are remarkably prepotent. In many instances as many as 90 per cent. of the stock got by Aberdeen Angus bulls from cows of a horned breed are polled or hornless.

In the native country of this breed, the tenant farmers have long looked upon cattle-breeding as their sheet-anchor, and, as a consequence, they bestow upon this industry great care and attention. This being so, bulls from pedigree herds are almost invariably used, a mongrel-bred bull being quite a rarity in many of the northern counties.

This fact naturally gives encouragement to owners of pedigree stock, and the number of well-bred pedigree bulls purchased annually by small farmers, and the stock in these men's hands, form an object-lesson which might, with profit, be carefully studied by owners of cattle in other districts of the country.

Influenced, no doubt, by Americans, who were then large purchasers of this breed, the Herd Book Society closed the Aberdeen Angus registration record, so that no animal other than that descended from Herd Book parents on both sides can ever qualify for registration. This policy is, to say the least, a doubtful one, and is, in the opinion of many, likely in future to lead to deterioration and loss of constitution. Several of the best and most highly valued animals of the breed, and parents of many famous show-yard animals, could have put forward slender claims to a



FIG. 9.—ABERDEEN ANGUS BULL, "PRINCE ITO" (12,869). Bred by and the property of Sir George Macpherson Grant, Bart., Ballindalloch. Winner of numerous firsts in his class, and champion of the breed at the "Royal" and Highland and Agricultural Society's Show, 1897. (*From the "North British Agriculturist."*)

pure Aberdeen Angus foundation, and, were the system of registration so arranged as to allow an animal, the result of a certain number of direct, well-authenticated crosses of Aberdeen Angus bulls, to be recorded, it would seem to be more in line with practical experience than the exclusive method at present in force.

The present-day objection to white markings upon this breed may also be said to be due to American influence. Many of the best and most prepotent sires and dams of the breed were the produce of animals having an amount of white on their underlines, and yet the present fancy would consign such animals to the feeding-stall, let their practical utility qualifications be ever so high. Breeders of pigeons, or such-like stock, which have little practical value beyond the ever-changing estimate of fancy and fashion, can well be excused when they lend themselves to please a fickle fancy, but in the matter of cattle-breeding the case ought to be altogether different.

Forty years ago, breeders of Aberdeen Angus cattle believed that a heifer with a white udder was more likely to be a good milker than one that was black and all black. The fact that a white udder on a black animal showed better than one without colour, may have had much to do with this belief, and need not be further referred to; but from no practical point of view can there be any excuse for the present-day objection to white udders or white underlines.

Twenty to thirty years ago, a number of Aberdeen Angus cattle having small loose horns, known as "scurs," were to be met with. These scurs are not attached to the bones of the head, but hang from the skin, and by many breeders and judges were not considered as any indication of impurity. Several of the most prominent judges at shows objected to prizes being awarded to animals with scurs, with the result that a strong feeling was aroused, and bulls with these appendages came to be considered as unsuitable as sires in pure-bred herds. This has resulted in the almost entire obliteration of scurs, and is here mentioned as a proof of the power which can be exercised by breeders of cattle over the characteristics of their herds in a comparatively short space of time.

Before the days of railways and steamers, beef produc-



FIG. 10.—ABERDEEN ANGUS COW, "LEGEND" (16,518). Bred by and the property of George Smith Grant, Auchorehan, Ballindalloch. First prize and champion cow at the "Royal" and Highland Shows, 1894. (From the "*North British Agriculturist*.")

tion, in the home of the Aberdeen Angus cattle, had not received the undivided attention of the cattle-breeders, as it has since done. With improved facilities of transit, the Northern farmers turned their attention almost entirely to cattle-feeding, to the neglect of the dairy, with the result that the Aberdeen Angus cattle are not now the deep milkers they were at one time said to be. While this is so, several of the families of this breed are really good milkers, and, were breeders to give their attention to the subject of milk, there can be no doubt the milking powers of the Aberdeen Angus could be greatly increased. That the Aberdeen Angus cows are not so devoid of milk as many assume may be gathered from the fact that on many farms where this breed is kept, the cows, beyond rearing their calves (and there is no district in the kingdom where calves are better reared), supply the household with milk, butter, and cheese.

The average carcase weight of a two years and four months old steer of this breed—an age at which many are fed off—may be put at 7 cwt.

DEVON CATTLE.

A well-fed Devon steer may be said to be one of the most typical specimens of a butcher's animal to be seen at a Smithfield Club show—an institution which may be looked upon as the greatest gathering of high-class specimens of beef cattle in the world. With an extraordinary flesh development on the portions of the frame from which the most valuable joints are cut, there is in this breed an exceptionally small amount of waste in the shape of bones and low-class meat. Like the Hereford, this breed must be spoken of as a local one in England, although abroad, more particularly in Australia, it is by many stock-owners held in high estimation. In comparison with many of the other breeds, the Devon must be considered as small; yet its beautiful proportions, small bones, and light offal assure for it a high place in all fat-stock competitions.

There are two distinct types of Devon cattle, designated North and South Devons; but as they are both red in colour and very much alike, except in the matter of size, the distinction is more or less a local one.



FIG. 11.—DEVON BULL, "LEONARD GOLSONCOTT." The property of Her Majesty the Queen.
Stock Bull at the Prince Consort's Flemish Farm, Windsor, 1897.

As a rule, the Devon cows are not considered deep-milking animals; yet in many districts, where attention has been paid to the dairy qualifications of the breed, instances are given of individual cows, and even families of cows, that might justly claim a high position amongst dairy cattle.

The average carcase weight of an ordinarily fed three-year-old Devon steer may be put at 7 cwts.

SUSSEX.

This breed has been greatly improved during the last twenty years. It takes its name from its native county, and, like several other breeds, it must be spoken of as a local one. High-class specimens of the breed have from time to time been taken abroad, but they do not seem to have made much mark, nor has the breed been taken up to any extent by stock-owners abroad.

Like the Devons, they are red in colour, with larger frames and stronger bones. Such specimens of the breed as are highly fed for exhibition at Smithfield are often wonderful examples of its early maturing powers; and in a comparative test as applied by a weight per age scale, they often stand near the top. As a breed, the Sussex cattle carry a larger proportion of lean flesh; but, judging from the udders of the cows seen at the national shows, their milking powers are by no means great.

In bygone days, the Sussex steers were highly valued as working oxen; and even to-day, in some parts of the country where oxen are used for cultivating the land, many arable land farmers consider the Sussex oxen stronger and more suitable draught animals than any of our other breeds of cattle.

The carcase weight of a three-year-old Sussex ox may be put at 8 cwts.

GALLOWAY CATTLE.

These cattle are natives of the south-west coast of Scotland, where they live, to a great extent, an out-of-door life in a comparatively mild but wet climate. This being so, they are justly looked upon as a hardy race of cattle, suited to live and thrive on rough, poor pasture.



FIG. 12.—GALLOWAY COW, "DORA OF DURHAMHILL" (13,550), Bred by and the property of John Cunningham, Durhamhill, Dalbeattie, N.B. Champion of the breed at the Highland and Agricultural Society's Show, 1896. (From the "*North British Agriculturist*.")

When fully matured, they are high-class butchers' cattle on account of their carcasses carrying a large proportion of lean meat.

There are, of course, different degrees of early maturing qualifications belonging to our different breeds of cattle, but it may be put as a truism that the breeds best suited to endure hardship are the least likely to mature at an early age. Compared, therefore, with many other breeds, the Galloways fatten slowly. Bred and kept on low-rented or inferior land till they are twenty-four to thirty months old, Galloway steers are found to be profitable grazing cattle in such districts as the Midlands of England, where the soil is good and herbage sufficiently rich to fatten cattle.

Judging by the specimens to be seen at our national shows, a great change has taken place in this breed during late years, and it is quite evident that the present-day breeders of Galloway cattle are aiming at breeding a class of cattle of a different type from those of twenty years ago. Formerly the prizes were awarded to thick-skinned, strong-haired specimens—in short, to animals indicating hardship-bearing powers; while to-day we find the winners with the soft, comparatively thin skins and mossy coats belonging to the less hardy, quicker maturing breeds.

The average carcass weight of a three-year-old Galloway steer may be put at 7 cwts., and being hornless, these animals are well suited for wintering in those districts where the cattle are fattened in lots in open or partly covered strawyards.

As a crossing animal, the Galloway is held in high favour; the product of the cows of this breed, when mated with the Shorthorn bull, possess much of the early maturing qualities of the sires, together with the strong constitution and hardness of the dams. In practice these black hornless cows are put to white Shorthorn bulls, and the produce, as a rule, being hornless and grey in colour, are known in the cattle world as "blue greys." They are highly valued by grass-land farmers, and are in great request as strawyard cattle.



FIG. 13.—HIGHLAND BULL, "LAOICH." Bred by and the property of John Stewart of Ensay. Winner of President's Medal as best animal of the breed at Perth, 1896. (*From the "Transactions of the Highland and Agricultural Society of Scotland," 1897.*)

HIGHLAND CATTLE.

The cattle of this beautiful and picturesque breed are natives of the mountainous country on the west coast of Scotland, where they are bred and reared in a semi-wild state. In their native district they lead an exposed life, gathering a living on the rougher grass and coarse herbage to be met with on the large sheep-runs common to the country. Feeding upon a class of grass which is unsuitable as food for sheep, a certain number of these cattle can be kept upon many sheep-runs without in any degree affecting the complement of sheep which the land is able to carry. Few Highland cattle are fed for the butcher on their native pastures; but they are taken south to fatten on the grass lands in the lower-lying country. When fattened, they are looked upon as first-class butchers' cattle, and when slaughtered at four years old, the average carcase weight of the steers may be put at 6 cwt.

When mated with Shorthorn bulls, the Highland cows produce a class of early maturing animals. They are, however, better suited for outdoor life than for straw-yard feeding, where their long, sharp horns are likely to be more freely used than might be comfortable for their neighbours.

DAIRY BREEDS.

RED POLLED.

It is with some hesitation that the Red Polled breed is classed amongst dairy cattle. This feeling is by no means due to any doubt as to the valuable milking powers of the cows, but to the fact that, both in the quality of his meat and the return that a Red Polled steer can show for the amount of food he consumes, he must be classed as a profitable beef-producing animal.

This breed is a native of the counties of Norfolk and Suffolk, and, as their name indicates, the animals are red in colour and hornless.

Of late years the breed has received considerable attention, and has been greatly improved; but, as is the case with all newly improved breeds, the females show more



FIG. 14.—RED POLLED BULL, "BARDOLPH" (977). The property of J. J. Colman, Norwich.
Winner of six first prizes in 1891 and 1892.

quickly the effects of care in breeding than the males. Indeed, many of the Red Polled cows and heifers, as seen at the national shows, seem to be of a much higher class than the bulls. Crossed with Shorthorn bulls, the Norfolk cow produces a fast-growing, easily fattened animal. An ordinary three-year-old Red Polled steer will weigh about 7 cwts. carcase weight.

Good cows of the breed are expected to give five gallons of milk per day when in full profit, and are credited with the valuable qualification of maintaining their full flow of milk for a longer period than almost any other breed.

AYRSHIRE CATTLE.

Ayrshire cattle have their home in the south-west of Scotland, and as a breed stand high amongst the dairy cattle of Britain. Like many of our dairy breeds, the Ayrshire has suffered from the fads and fancies relating to what is termed "showyard form." At one time, not so many years ago, small teats were aimed at, and this was carried to such an extent as to make the process of milking a prize Ayrshire cow an art difficult to be learned. The fancy for small teats has now been abandoned, but one sees with regret the continued selection of a thin-chested, weakly constituted animal as the prize-winning cow. Neither can there be any logical reason for the present-day fancy for light-coloured animals, such as one sees preferred at shows; and there need be no hesitation in stating that many of the herds of Ayrshires in the possession of farmers who have never pandered to fancy or showyard fashion, have stronger constitutions, are more useful animals, and altogether are better specimens of the breed than many of the prize-winners at the national shows.

Although Ayrshires are spoken of as a milk breed, the stronger class of cows when put to a Shorthorn bull can produce a quick-feeding animal of considerable weight. At present a large number of the owners of Ayrshire cattle sell their calves when a few days old. These calves are taken into the manufacturing districts and sold to butchers in the poorer quarters of the cities as veal!

The Ayrshire cow takes a high position as a dairy

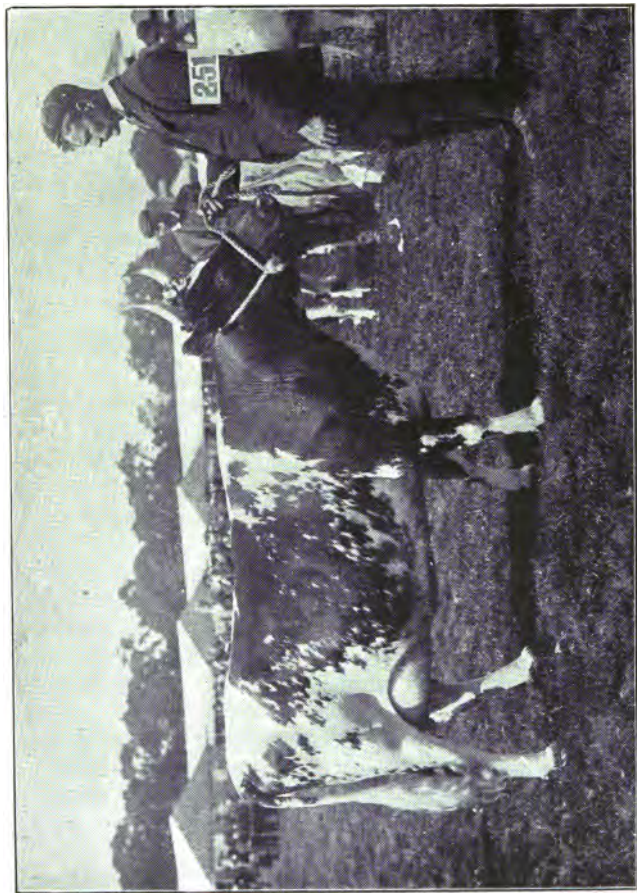


FIG. 15.—AYRSHIRE COW, "JUDY" (8058). Bred by and the property of Alexander Cross, Knockdon. Winner of President's Medal for the best Ayrshire at Highland and Agricultural Society's Show, Perth, 1896. (From the "*North British Agriculturist*.")

animal, and for the amount of food consumed she may be reckoned to give as large a return of milk as any animal of our dairy breeds. In full profit, an ordinary Ayrshire cow will give from four to five gallons of milk per day.

JERSEY CATTLE.

The Jersey is a native of the Channel Islands, and as a villa cow, in a mild climate, has no equal. For her live weight the Jersey cow may be justly termed a deep milker. It is, however, in the quality of her milk that she stands pre-eminent, as the percentage of butter-fat in Jersey milk exceeds that of any other breed. This is, no doubt, the result of long and careful breeding, and reflects much credit on the intelligence and care of the Channel Island cattle owners.

In the south of England, Jersey cattle have of late years largely superseded Shorthorns and other breeds as dairy cattle. The growing wealth of the population and the increased facilities of travelling, which allow business men to live in the country while conducting their business in the cities or towns, has led to a great increase of suburban homes where cows are kept to supply milk and butter for the households.

Under such circumstances, quality is a much more important matter than the cost of the article produced, and as the villa cow is only expected to serve one purpose, viz. that of producing good milk, the Jersey (comparatively worthless as a beef animal) has become a general favourite.

The want of constitution and strength of the Jersey cow render her unsuited for any other than a mild climate, nor can she ever take the place of "the general purpose cow" (the Shorthorn), which she is displacing in many districts in the south of England.

Jersey cattle are much in favour in America, where suburban residences are even more common in the neighbourhood of cities (there are no "towns" in the United States) than in Great Britain.

The milk record of a Jersey cow may be put at three gallons per day.



FIG. 16.—JERSEY COW, "BETSY." (From the "*Live-Stock Journal*!")

GUERNSEY CATTLE.

The Guernsey cow is a stronger-boned, larger-framed animal than the Jersey, and is justly famous for the quantity and quality of her milk. Although perhaps not so popular as the Jersey as a villa cow, the Guernsey may be spoken of as a more suitable cow on a farm, as her calves got by a Shorthorn bull are capable of growing into useful farm stock. Indeed, cases might be quoted where a dash of Guernsey blood brought into a cross-bred Shorthorn herd improved the quality of the milk, without to any great extent lowering the value of the steer stock as butchers' animals.

There is scope for much being done in this direction by ordinary farmers; and well-directed efforts at cross-breeding in herds where the owners are in no way trammelled by herd-books, ought to lead to rapid improvement at a small outlay. Bull calves of the Guernsey breed may be bought at moderate prices, and might well be put to a few cows in a farmer's herd. The female stock, the result of the cross, could then be used as foundation animals to put to Shorthorn bulls, with every prospect that they would produce a class of rent-paying cows with richer milk-producing powers than those possessed by the nondescript animals too often seen in many parts of the country.

KERRY CATTLE.

This breed is a native of the south-west coast of Ireland, and is justly famous for its dairy qualifications. Although long neglected, considerable attention has of late years been given to the improvement of this useful, hardy breed, and it may be questioned if any breed of dairy cattle can compare with the Kerry in being able to live, thrive, and milk well upon the poorest of poor pastures.

The Kerry lives an exposed life in its native country, where, if the temperature is never very low, the rainfall is very great, and the weather often tempestuous. If bred on rich soil, the Kerry loses, by increased size and flesh development, several of its characteristics, yet it maintains its great dairy qualifications. In many of the parks attached to "the stately homes of England," where, through



FIG. 17.—KERRY COW, "NORA IV." (599). The property of the Right Hon. Viscount de Vesci, Abbeylax House, Abbeylax, Ireland. Best Kerry cow and champion of all dairy breeds at the Royal Dublin Society's Show, 1897. (From *Photograph by Lafayette, Dublin.*)

game preservation and other causes, the herbage is poor, there is perhaps no breed of dairy cattle that will show the same good milk record, so far as quantity and quality are concerned, as the Kerry cow and her near relation the Dexter. Having been bred or descended from animals a long time bred in a district where farming has been neglected, and where rough grasses form the means of subsistence, these cattle live and thrive upon such foods as would be quite unsuitable for many of the more highly improved breeds.

In size the Kerry is somewhat larger than the Jersey, but smaller than the Ayrshire; the milk record of an ordinary Kerry cow may be put at three gallons per day.

DEXTER.

This breed was for some time called the Dexter-Kerry; and there can be little doubt but that the Dexters are intensely inbred Kerrys.

A Mr. Dexter, some sixty years ago, recognising the valuable qualifications of these cattle, formed a herd of them, and, having done so with much care and judgment, his cattle quickly acquired a great local reputation. After his death the herd was dispersed, and animals of the type he had bred came to be known as "Dexters."

They are to be met with in the very poorest parts of the high, barren, uplands of Kerry, and are in every sense of the words "the poor man's cow."

The average height of a full-grown cow, measured at the shoulders, is about forty inches, and it is not at all uncommon to find these small animals giving as much as three gallons of rich milk per day.

They stand on very short legs, and are altogether shaped like a miniature Shorthorn, being wide in the chest, broad along the back, with square quarters and full, deep thighs.

A Dexter steer at four years old, after having been fed on moderately good land for twelve months, will weigh about 5 cwts. carcase weight, and there is no class of beef worth more per pound than that of a well-fattened Dexter.

The Dexter is highly prepotent, and, when crossed with any of our more improved breeds, seems able to transmit

its peculiar breed qualifications in an extraordinary degree. Indeed, cross-bred stock, the produce of Shorthorns, Herefords, and Aberdeen Angus bulls and Dexter cows, almost invariably retain the size and shape of the dams, although the infusion of improved blood tends to increase their early maturing qualifications.

A most interesting and valuable experiment in the matter of cross-breeding, or rather up-grading, has been carried out for many years at Straffan House, County Kildare, Ireland. Some thirty years ago Major Barton became possessed of a small Dexter cow, and, the animal being a deep milker, her female calf by a pure-bred Shorthorn bull was retained in the herd. From this foundation a small herd of beautifully-shaped deep-milking cattle has been bred, the present-day specimens being the fifth, sixth, and seventh generations from the original Dexter cow. The grading-up has invariably been carried out by means of Shorthorn bulls, and while the animals to-day have all the shapes of high-class Shorthorns, they stand very little higher than the foundation Dexter cow. As milking cattle they are, for their size, truly wonderful, several of these small cows giving five gallons of rich milk per day when in full milk.

CROSS-BRED CATTLE.

By far the larger number of cattle in the hands of the ordinary farmers belong to a class known as "cross-breds," and as beef- and milk-producing stock they are, under many circumstances, more profitable than pure-bred animals. In the foregoing pages reference has again and again been made to the valuable stock got by Shorthorn bulls from cows of various breeds, but it may be well to consider the question of cross-breeding where the possession and maintenance of two pure breeds for the production of cross-bred stock would be impossible. As there is, however, much misconception regarding cross-breeding, it is deemed advisable to devote attention to a subject which must affect a large body of cattle-breeders.

Scrubs and Grades.—In Britain the term "cross-bred" has come to be applied to all cattle other than those belonging to any one of the many established pure breeds. In the United States the non-pedigree cattle of the country



FIG. 18.—DEXTER BULL, "BANTAM" (257). The property of H. R. H. the Prince of Wales.
Winner of the first prize and cup at the "Royal" Show, 1897.



FIG. 19.—DEXTER COW, "WEE KATE" (694). The property of E. S. Woodiwiss, Hill Place, Upminster, Essex.
Winner of first prize at Royal Dublin Society's Spring Show, 1897.

are spoken of as "grades" and "scrubs," and in dealing with the subject of cross-bred cattle these terms may be appropriated with advantage.

What are known as "scrubs" are animals that have received no attention in the matter of their breeding, and consequently belong to a low-class type, unsuitable in every respect, if the owners, through land cultivation or other means, are enabled to ensure a daily returning supply of milk- and meat-producing foods. If these conditions are wanting, as is often the case on ranches in America or on cattle-runs in Australia, the "scrub" animals may and do live, and slowly mature, under circumstances where the improved stock could not exist. It has to be acknowledged that scrub cattle are not confined to poor ranching lands of America, nor to the arid cattle-runs of Australia, but are met with in all countries in the world where owners have, through carelessness and inattention, neglected their business. No doubt the introduction of pure blood into a herd of scrub cattle is the quickest and best means which can be adopted to improve it, but where such blood is not available, selection can do much in changing the character of the stock.

"Prime Scots."—The result of the introduction of pure blood into a scrub herd is the production of "grades," a class whose value may be said to depend upon the amount of pure blood in their veins. No better example of the grading-up system of cattle-breeding can be given than that pursued by the North of Scotland cattle-owners, whose animals command the highest prices in the principal meat markets. Few of those cattle known in the London markets as "Prime Scots" are pure-bred, but every one of them may be truly said to be the produce of a pure-bred sire.

If the system of breeding which has produced the high-class cattle known as "Prime Scots" be looked into, it will be found that it is from first to last one of grading-up, as it seldom occurs that two pure-bred parents of two distinct breeds are mated for the purpose of producing ordinary farming stock. Those northern breeders have two distinct breeds at their command, and knowing the qualifications each possesses, they use in their herds of graded cows either a pure-bred Shorthorn or an Aberdeen Angus bull, as their fancy or knowledge of their business may dictate. Both



FIG. 20.—SHORTHORN DEXTER, "TINY TIM." Bred by and the property of Major Barton, Straffan House, County Kildare. Winner of medal at the Royal Dublin Society's Show, April 1897; then four years old, and weighing 18 cwts. Height at shoulder, 48½ inches.

the Shorthorn and the Aberdeen Angus breeds have their own peculiar qualifications, which render them valuable, but under many circumstances a carefully blended combination of both bloods suits the ordinary farmer better than either of the pure breeds. To possess the desired grade or cross-bred, when a herd of graded cows is owned, Shorthorn bulls are often used, till the stock to some extent assumes the Shorthorn type, when the Aberdeen Angus is brought in. Alternating from one breed to the other in this way, and invariably using pedigree sires, those northern breeders have produced a class of farmers' cattle highly suited for their purpose.

Those cattle are referred to because their production is an outstanding example of the advantage of care and judgment as displayed by a class of farmers owning a mixed-bred stock of cows, living in a severe climate, and farming and paying rent for land which may be justly termed poor. What has been done in the North of Scotland is equally open to cattle-owners in all parts of the country, as Shorthorn blood may be mingled in a similar way with the Galloway, the Red Polled, the Hereford, or, in fact, with that of any of our breeds, with the certainty that it will improve the farmer's stock. It may, however, be laid down as imperative, under such a system of grading, that pure-bred sires, of whatever blood, must be used, and the best and most suitable even of those pure-bred sires that can be obtained within the means at the breeder's command.

In selecting a sire, a knowledge of his pedigree is most essential, and care ought to be taken to secure him from a herd known as possessing the several qualifications needed in the farmer's stock. A bull used in a herd exercises an enormous influence for good or evil before the effects of his use can be thoroughly understood, and this holds good in an equal degree both in a herd of mixed-bred cows and in one where the dams are pure-bred animals.

CATTLE REARING AND FEEDING.

A farmer who becomes possessed of a herd of common country cows ought to give the matter of selection of a sire his most careful consideration. In a herd of mixed cows, the influence of pure-bred sires is, as we have just stated,

truly wonderful, and three or four crosses of such sires are sufficient to grade-up a stock of feeding cattle, until they are quite as good, for all practical purposes, as pure-bred animals.

Production of High-Class Beef.—One of the most essential points to be observed in rearing cattle, as well as all kinds of farm stock, is the making sure that they never lose anything they have gained. The system pursued in many districts of allowing young, growing cattle to become lean, through exposure and hardship undergone at any one period of their existence, can never result in the profitable production of high-class meat.

In no district of Britain has the management of farmers' stock received the same attention as in the North of Scotland, and therefore a description of the system generally pursued there may be interesting.

The Scotch System of Cattle-Rearing.—Having been careful as to the breeding of their stock, the North of Scotland farmers act upon the principle of never allowing their young animals to lose their calf-flesh. The climate of their country is a severe one, their winters necessitating a long term of house-feeding, and experience has taught them the importance of warmth and comfort in the profitable production of beef.

To enable them to produce the greatest weight of beef at the least cost for food, their feeding-houses, termed "byres," are kept at the high temperature of 56° to 60°. The feeding cattle are tied by the neck in stalls, fed regularly, and curried and brushed every day; while they are well washed and their skins made quite clean at such short intervals as may be deemed necessary, to prevent the hair becoming matted through sweating. By thus keeping the skins of the animals clean, a twofold purpose is served—a higher temperature can be maintained in the byres without the risk of loss through sweating, and at the same time there is a total absence of skin irritation, with its consequent restlessness. The advantages of such careful management do not end with the gain of time and reduction of quantity of food necessary to mature the Scotch byre-fed cattle. When put on the market, an animal treated as described has a beautiful bright pile, which at once catches the buyer's eye, and tends to command a ready sale at the highest market price.

Yard-Feeding.—On many arable farms under the four-course, or any rotation by which only a small extent of the land is in grass, cattle are fed in partly covered or altogether open yards. On such grain farms the quantity of straw produced is large, and in many districts may be said to have no value beyond what it is worth as manure. Such being the case, the cattle are wintered in yards deeply littered with straw, and where these are partly covered or otherwise well sheltered, they afford comfortable winter quarters for the stock. In many districts covered yards are in much favour, and, where ventilation has been properly arranged, the comfort of the animals can be fully assured. Yard-feeding has one great disadvantage, which is that the stronger animals take more than their share of the best food, and in consequence the weaker ones must suffer. In Norfolk a system of box or pit feeding is general. Cattle are placed, either singly or in pairs, in well-littered pits or boxes, from eight to twelve feet square, with the feeding-troughs so arranged that each animal may get its proper share of food. The manure made either in boxes or covered yards is much more valuable than that made in open or partly covered yards.

Pasture-Feeding.—Large numbers of cattle are fed on old grass pastures, where they live an outdoor life. In a good climate, where the subsoil is open, or where the land has been well drained and the natural shelter is good, they may be said to suffer little from the exposure to which they are subjected. While this is so, there must, under the most favourable circumstances, be much waste, as a large portion of the food consumed in cold weather must go to maintain the necessary heat of the body. Where out-feeding is pursued, cattle are seldom fit for the market till they have attained considerable age. This being the case, their carcasses, when cut up into large joints, are worth less per pound than those from cattle that have been fattened at an earlier age.

Sheds erected in grass pastures afford opportunity for shelter during bad weather, and as these can be erected at small expense, there is no excuse for the waste, and in many cases the cruelty, which takes place under a system of management that is too often seen.

WORKING OXEN.

Many of the present generation of farmers look upon cattle as being simply milk- and beef-producers. If, however, we look at any work dealing with the subject of cattle published in the early part of the century, we shall find that the oxen of many of the breeds are spoken of as being in a special degree suitable as working animals. At the present time in several districts both in England and Scotland a considerable amount of land cultivation is accomplished by oxen. In many countries abroad, oxen are largely used on the land, while in many again the bullock-waggon is the principal means of road transport. Few but those who have had practical experience of ox-labour can understand the strength and endurance of a pair of properly harnessed oxen. In ploughing, harrowing, and such like, the pace at which oxen move may seem slow; but in a field where the turnings are frequent, with a furrow say 200 yards in length, the oxen swing round at the end in less than half the time occupied by horses. In ploughing land where rocks crop up near the surface, oxen are preferable to horses as a team. The slow steady draught of the former enables the ploughman to manipulate the plough so as to avoid contact with the rocks, and yet turn a comparatively even furrow.

In many foreign countries where oxen are used as beasts of burden, they are harnessed in what to us would seem a cruel way. They are made to pull by their heads, the pole of the waggon being strapped to the horns of the wheelers, while the heads of the oxen in front are strapped to cross-trees fixed in a chain attached to the waggon. In other countries boughs or yokes are fixed on the neck in front of the shoulders, as was the custom in Britain many years ago. Now, however, in this country, when oxen are used as working animals, they are harnessed much in the same way as horses, but are seldom seen yoked in carts, their work being almost entirely confined to ploughing, harrowing, and such like. Collars made to open and buckle at the top are placed on the neck in a similar position to that on a horse; but as the ox has more upright shoulders than the horse, the draught-line is much lower.

A back-band is placed across the body to support the traces, and so prevent them getting amongst the animal's legs. In some districts a bit is used in a bridle, in others a ring is put into the nose to which the rein is attached; but the most common head-gear is a simple halter. In those districts where oxen are worked, they very soon learn to act by command, and it would be looked upon as evidence of insufficient training were the driver led to depend much upon the reins in guiding his team.

WEIGHING CATTLE.

A farmer having bred, reared, and fattened his cattle, must find a market in which to dispose of them. It may be he has a ready sale on his farm for the fat stock he can produce, or he may have to take the animals to a fair or market, while in other cases they have to be consigned to a live-stock agent in distant markets, a commission having to be paid for their disposal. In every case the farmer ought to weigh his animals before they leave his farm, and thus, knowing the weight, he is enabled to calculate the price per pound realised, and also the individual share with which each animal may be credited. The proportion of dead to live weight varies much in different animals, and a cattle-breeder ought to aim at the production of animals whose carcase weight bears the highest possible percentage to that of their live or gross weight. These percentages vary from 50 to 70 per cent., and any one can at once understand that the breeder who puts on the market animals to realise the latter percentage can afford to sympathise with his neighbour whose stock only reaches the former standard. On every well-equipped farm a weighing-machine should be erected, so that whatever may be sold off or brought on to the farm can be weighed, and deductions drawn likely to influence future proceedings. And not only should stock be weighed when leaving the farm, but periodical records should be kept, showing the returns left by the individual animals for the food consumed. Such a system of weighing carefully carried out, in conjunction with a searching examination into the breeding and individual points of each animal,

would unquestionably afford a safe basis for the line to be pursued in cattle-breeding.

That these things have been neglected by farmers generally cannot be gainsaid, and in no other business in the world except farming would a product leave the producer's hands without his being able to say whether it had left a margin of profit or had been sent out at a loss.

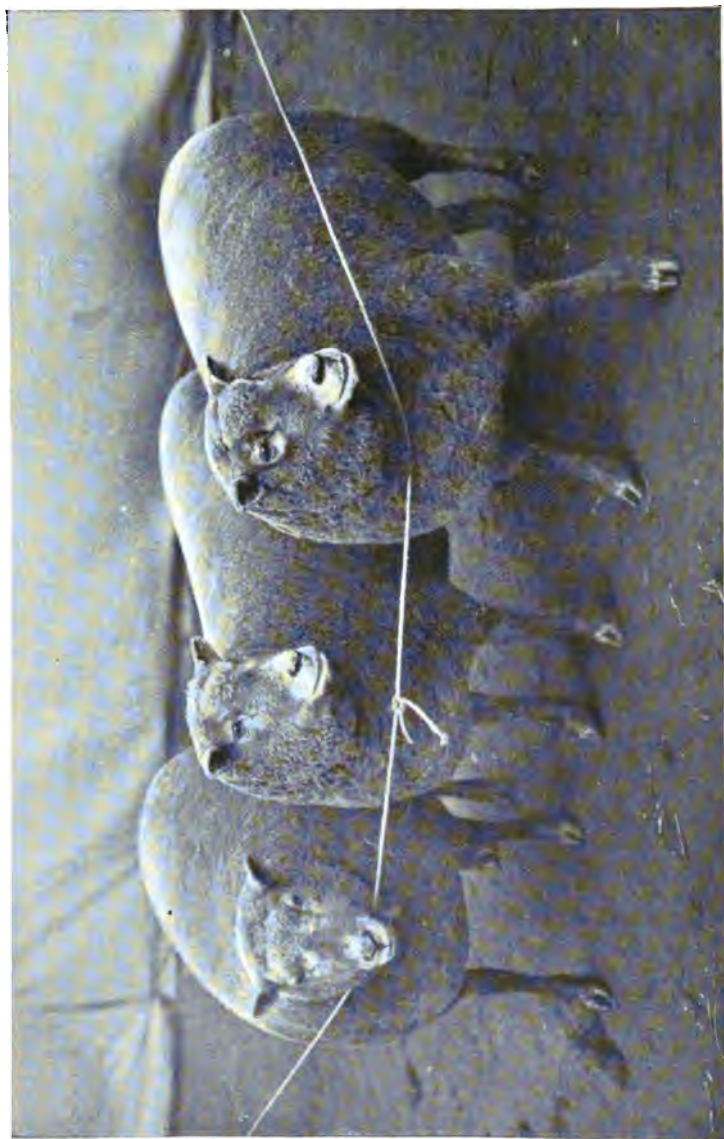


FIG. 21.—PEN OF SOUTHDOWN SHEEP. Bred by and the property of H.R.H. the Prince of Wales, K.G.
Reserve Number for the Southdown Cup at Smithfield Club Show, 1897. (*From the "Mark Lane Express."*)

CHAPTER VI

SHEEP

Twofold object of sheep-rearing—Sheep-breeding in the Colonies and at Home. LONG-WOOLLED, SHORT-WOOLLED, and MOUNTAIN SHEEP:—Principal breeds. Management. ARABLE LAND. SHEEP-FARMING:—Rearing of lambs.—“Fly-blow” and sheep-dips. BREEDS OF LONG-WOOLLED SHEEP:—The Leicester—The Border Leicester—Lincoln sheep—Cotswolds—Roscommon. BREEDS OF SHORT-WOOLLED SHEEP:—Southdown—Shropshire—Suffolk Down—Hampshire Down—Oxford Down—Dorset. MOUNTAIN SHEEP:—Cheviot—Black-faced Mountain sheep.

SHEEP have a twofold purpose to serve, viz. the production of wool and mutton; and, in consequence, their proper mating and breeding require more careful attention than may be said to be necessary in the case of either cattle, horses, or pigs. Although mutton is now the chief object in sheep-breeding in the United Kingdom, even the average two-shear sheep (twice shorn, or two-year-old) will have produced wool, during its life, to the value of nearly one-half the amount which is likely to be realised for its carcase of mutton when slaughtered.

Sheep-Breeding in the Colonies and at Home.—Until lately, when, by the aid of freezing and refrigerating the carcasses, mutton can be shipped to this country to be sold as fresh meat, wool was the principal source of income derived from flocks of sheep in Australia and other distant sheep-owning countries. This being so, much attention was naturally given to the propagation of a class of sheep carrying heavy fleeces of wool. As a rule, the Merino breed was generally in favour, and the really perfect system of breeding for wool which has been pursued in several of our Colonies deserves the highest praise. Not only is this so, but the practical manner by which the opinions and advice of experts are brought to bear upon the subject might well lead us to reflect upon the advantages of some such system, could it be introduced at home.

It is not given to every one who, through a combination of circumstances, finds himself directing the manage-

ment of a stud, a herd, or a flock, to have an inborn or intuitive knowledge of his calling, which may be said to be the heritage of few. None will question that the knowledge of such subjects is a gift, and few will deny that much of this knowledge may be acquired through tuition.

Stock-breeding is a most complex subject, and, in determining the class of sheep suitable for a particular district, much attention ought to be given to the matter of practical experience. Although far from asserting that in all cases the farmers in each particular district keep the class of sheep best suited for that district, still, as a general rule, the class of sheep common in any district will be found to have many qualifications rendering them favourites with their owners. While this is so, it must not be assumed that the improvement of flocks, through introduction of new breeds, should not be attempted, although a change of breed should not be made without carefully conducted experiments. These need not be made upon an expensive scale, nor at much risk. In making these experiments, it is well to see that they are carried out in a systematic way. Instances might be quoted where a distinctly different breed of sheep from those generally kept was introduced into a district, and kept separate from the ordinary flock; they were grazed, a small number together, in the fields along with cattle or other stock of the farm, and records kept which went to prove their great superiority. All practical sheep-farmers would regard this as no test of one breed against another, and yet, as has been said, instances could be given of men pursuing such a system and drawing favourable conclusions regarding new breeds which practically had never been fairly tested.

The British farmer is by no means the ignorant, prejudiced mortal he is sometimes represented to be. If he were so, how, it might be asked, has it come to pass that in no country in the world has the improvement of livestock made such great strides? The whole of our breeds of domestic animals are eagerly sought after by all nations in the world; and it can confidently be said that much of the credit of improving and maintaining the improvement of the horses, cattle, sheep, and swine of the world is due to the ability and enterprise of the tenant-farmers of Britain. Be this as it may, an owner of sheep who intends

breeding in a district new to him will do well to begin, at least, by keeping the sheep of that district; and before he attempts a change of breed, he ought to make sure that he has been giving such sheep a fair trial. This can only have been done if he has been using the best available rams, and mating these with the best ewes of the breed. In other words, before he condemns a breed he ought to cull carefully when selecting his breeding ewes, even after he has made certain that his rams are the best specimens of the breed he can procure. It may be said that this might lead to reduction of stock; but the rate at which the animals multiply admits of harder culling in a flock of sheep than could be practicable in a herd of cattle. If, after due consideration, and systematic experiments carefully carried out, an owner becomes convinced that another breed of sheep than those kept in his district will prove more profitable, he is then quite entitled to make a change.

Long-Woolled, Short-Woolled, and Mountain Sheep.—

Sheep may be divided into two great classes—long-woolled and short-woolled, and to these may be added the distinctive breeds known as Mountain sheep; and any one commencing sheep-farming must be guided by the climate, the situation, and soil of his farm as to the class he ought to breed. The heavy-bodied, long-woolled Lincoln breed would be quite out of place on the light Sussex Downs, as would many of the large English breeds on the mountains of Scotland.

The principal breeds of sheep are:—

The Long-Woolled	Leicester.
	Border Leicester.
	Lincoln.
	Cotswold.
	Roscommon.
The Short-Woolled	Southdown.
	Shropshire Down.
	Suffolk Down.
	Hampshire Down.
	Oxford Down.
	Dorset.
The Mountain Sheep	Cheviot.
	Black-faced Highland.

Besides these, there are other breeds which may be spoken of as subdivisions of the above; and, although they may have a certain local reputation in their respective districts, the consideration of them is quite beyond the province of this short treatise.

It will be found that in many districts cross-bred sheep are almost universally kept, the farmers believing that as mutton- and wool-producers the cross-breds answer their purpose better than would any pure-bred flock.

MANAGEMENT.

The system of management of sheep differs much under the various circumstances in which the flocks may be placed. In a strictly arable country the sheep are more or less kept in continual confinement, while in a grass country they are simply restrained from wandering by being shut up in large grass fields. Again, in many districts where large numbers of sheep are bred and fed, they wander in a semi-wild state over large tracts of rough pasture lying on mountain or hill sides, being tended by shepherds who depend upon their dogs to keep their flocks upon their own ground, and otherwise handle them.

Arable Land Sheep-Farming.—In many districts arable land farmers depend almost entirely upon sheep to consume such produce of their farms as they do not sell off in the shape of grain, potatoes, &c., a few cattle being wintered in yards to convert the straw into manure.

On such farms sheep are confined to particular portions of the fields by means of fencing composed of nets, either made of rope or wire, or by wooden or iron hurdles. These nets or hurdles are regularly moved, thus allowing the sheep a fresh break or "fold" daily, while at the same time the system ensures close cropping in the case of grass and other green foods, and the total consumption of the crop if the animals are being fed on roots.

In many districts the lambs are allowed to have the run of a fresh break a day before the ewes and other sheep; and this is managed by arranging a number of creeps, or small openings, in the net fences or hurdles, large enough to allow the lambs to pass out and in, although forming a perfect barrier for large or full-grown sheep.

In Suffolk, where large breeding flocks of sheep are kept upon light land, and where much of the pasture is grass of the poorest quality, the sheep are managed in the following manner. The ewes and lambs are confined during the night in a very second-rate pasture, often the remains of a catch crop preceding barley; and at a regular hour in the morning the shepherd starts his flock, shedding the lambs from the ewes, and while leaving the former on a fresh break of clover, rape, mustard, or turnips, he moves the ewes to find their food on the outlying poor pastured lands. The ewes are moved along quietly for several hours, gathering what they can pick, and are brought back in the middle of the afternoon to join the lambs in the partly-eaten break which the latter had fresh in the morning. After this is cleared up, the whole flock is again laid off on their night field.

This system of management of a flock, on such land as has been spoken of, at once commends itself to a practical mind; but to those who may only have had experience of a flock of mountain sheep, the idea of separating the ewes from the lambs would seem to be ludicrous in the extreme.

Rearing of Lambs.—Much of the success of sheep management depends upon careful attention to details which are quite practicable on arable farms. For instance, speaking in a general way, about one half of the ewes in a flock will produce and rear twin lambs. The ewes with two lambs, as can be easily understood, have a harder task during the suckling season than those with single lambs. To have a level or even lot of lambs is one of the great objects of flock-owners, and this can only be attained by giving the ewes nursing twin lambs a better "run" than the others. If possible, therefore, the portion of the ewe flock nursing double lambs should be kept by themselves, where they ought to receive better food than their less productive neighbours.

In the case where lambs are sent to market as fat from their mothers, a different system is pursued than where they are not sold off till they are one or two years old. If the lambs are to be sold as fat from their dams, what is called a "flying stock" of ewes is often kept. Ewes are bought each autumn, kept during the winter, well fed while rearing their lambs, and sold off as fat at the same time as, or soon after, the lambs are marketed.

Much of the success in bringing lambs early to the fat market depends upon a well-arranged system of management, by which the dams are provided with food of such a nature as to keep up the milk supply. If, through untoward circumstances, more especially during the first month after lambing, the milk supply becomes reduced, the lambs immediately suffer, and it is difficult—it might well be said impossible—to regain a loss occasioned by even one week's check. For this reason, except where the climate is mild and early grass during the spring months can be safely counted upon, it will be found that it is more profitable to have lambs dropped during March or beginning of April rather than in January or February.

Lambs intended to be sent to market as fat lambs are seldom docked or castrated, and if the ewes have been well attended to and kept free from ticks, the lambs seldom require bathing.

"Fly-Blow" and Sheep-Dips.—With lambs intended to be run on as hoggets, it is necessary that they should during the early summer be bathed or dipped in one of the many sheep-dips now in general use. This will answer a double purpose, viz. the destruction of ticks, and at the same time the prevention, to a great extent, of what is known as "fly-blow." During the warm damp weather much careful inspection of a sheep flock is necessary. The fly deposits its eggs upon the damp wool, generally towards the hind-quarters, and grubs or maggots are very soon hatched. These immediately begin to feed on the skin tissue, eating their way into the flesh, causing great loss of wool, and even the death of the animal. A careful shepherd at once detects the first symptom of "fly-blow"; in the early stages an application of one of the common sheep-dips will destroy the maggot and give instant relief. A mixture of equal parts of paraffin and water, if carefully applied, is often used to destroy the maggots.

At weaning time care ought to be taken that the lambs deprived of milk be placed in a sweet fresh pasture, so that they may not lose condition. On arable farms it is generally arranged that a freshly grown clover field is set apart as a weaning pasture, and if the lambs, when suckling, have been accustomed to "trough-feeding," a daily allowance of cake and corn at this stage is of much value.

BREEDS OF LONG-WOOLLED SHEEP.

THE LEICESTER.

The Leicester is a native of the rich lands in the Midland counties of England, and is said to have been much improved by Bakewell, the famous breeder of long-horned cattle. There can be no question but that the Leicester

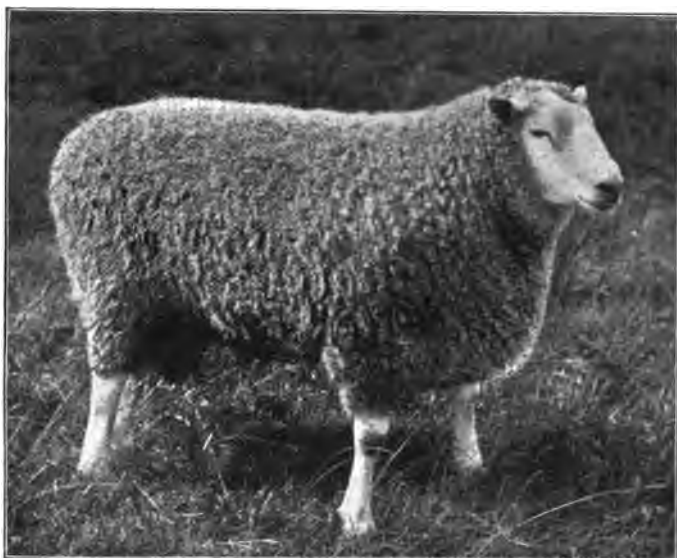


FIG. 22.—LEICESTER RAM. Bred by and the property of George Harrison, Gainford, Darlington. First prize shearling ram at the "Royal" Show at Manchester, 1897.

did much good in days gone by, when mated with slow-feeding sheep, then common throughout the country. Of late years they have been less extensively bred, as the butchers find the mutton-consuming public now look for meat with more lean flesh and less fat than that belonging to the English Leicester as a breed.

Rams of this breed are principally used for crossing purposes, and when mated with Mountain breeds they

produce a class of sheep which commands a ready sale in the fat markets.

They may be described as rather short, thick-set sheep, with wide chests and broad backs. The average weight of wool of a well-kept Leicester sheep may be put at 7 to 8 lbs., and the carcase weight, at one year and three months, after the first shearing, at 70 to 80 lbs. In giving the carcase weight of this and other breeds of sheep, or even the weights of wool, such specimens of the different breeds as are specially fed for show purposes are not taken into consideration.

THE BORDER LEICESTER.

This breed has its home in the Border counties of England and Scotland, where the soil may be spoken of as sharp and friable. At one time it was looked upon as a section of the English Leicester. As we find the breed to-day, it is a longer, more active animal than the English Leicester, having a clean head, covered with hard white hair, a wide chest, and well arched ribs. In wool the Border Leicester ram looks well proportioned, but when shorn his middle seems light and his legs seem unduly long. Mated with both the Cheviot and Black-faced Mountain ewes, the produce are quick-feeding, hardy sheep, much in favour with the northern farmers.

The cross with the Cheviot forms a large proportion of the sheep stock throughout the eastern and south-eastern counties of Scotland and the North of England. The border Leicester and Black-faced crosses are to be met with on the higher lying districts, and are held in high estimation as mutton-sheep.

The tendency has been to develop the mutton capabilities of the Border Leicester, somewhat to the neglect of the wool, and many of the pure-bred sheep lack that underline covering of wool which is looked for in all well-woolled breeds. The care bestowed on the mutton-producing properties has doubtless developed the early maturing tendency of the breed, and in consequence, when lambs are put upon the market, either as fat lambs or to be fattened under twelve months old, the Border Leicesters or crosses from them are popular with arable land farmers.

It is worthy of notice, however, that, much as this breed is appreciated in the North, it is seldom seen in the markets of the South of England, the southern

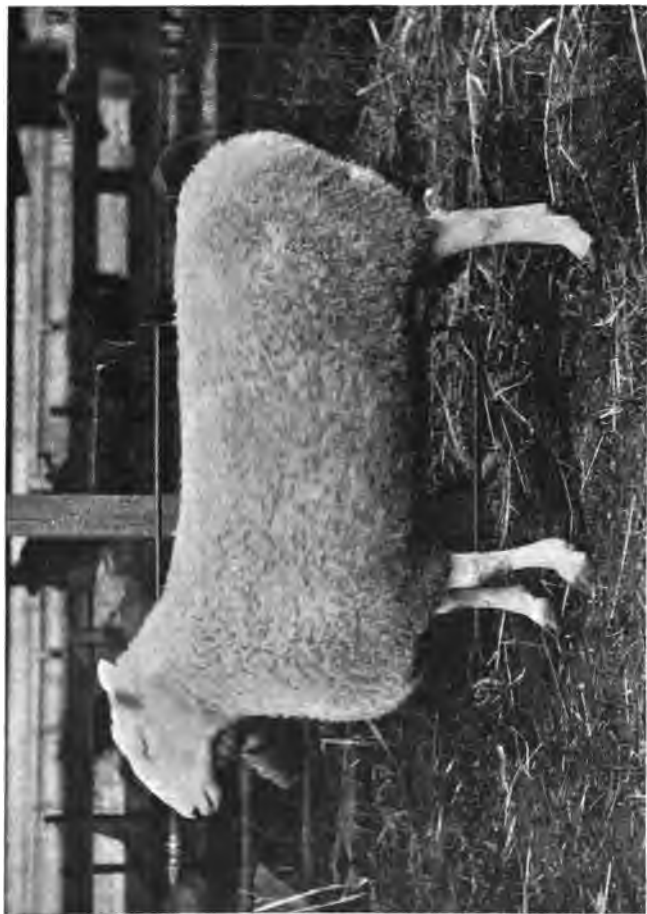


FIG. 23.—BORDER LEICESTER RAM. Bred by and the property of Robert Wallace, Auchinrain, Mauchline. Winner of the gold medal as the best Leicester ram at the Highland and Agricultural Show, Glasgow, 1897. (*From the "North British Agriculturist."*)

butchers having a strong prejudice in favour of short-woolled, dark-faced sheep.

The Border Leicester may be said to carry a 7-lbs. fleece, and to weigh at one year old about 70 lbs.

LINCOLN.

The Lincolns are large-framed, quick-feeding sheep, carrying heavy fleeces of long, lustrous wool. Their great feeding capabilities, in conjunction with the texture and quality of their wool, have made them much sought after by foreign sheep-owners, particularly in those countries where the native breeds have been for a considerable time



FIG. 24.—LINCOLN RAM, "RIBY GENERAL No. 2" (1195). Bred by and the property of Henry Dudding, Riby Grove, Lincolnshire. Sire of many winners.

crossed with the Merino, until they have to a great extent assumed the latter type. Like all large-sized, fast-growing breeds, the Lincolns are rather unthrifty mutton-sheep, as the proportion of fat to lean in their carcasses is too great for the present-day tastes of the mutton-consuming public. On rich lands, however, they mature early and grow to great weights, many of the hoggets, or one-year old sheep, reaching 100 lbs. carcass weight, while 10 lbs. may be put as their average wool-bearing powers.

COTSWOLDS.

The Cotswolds are large-framed, upstanding sheep, with long broad backs, and rather long, thin-looking necks. They have been described as Leicesters of a large type, and seem to be well adapted for the high-lying country known as the Cotswolds in Gloucestershire and Oxfordshire.

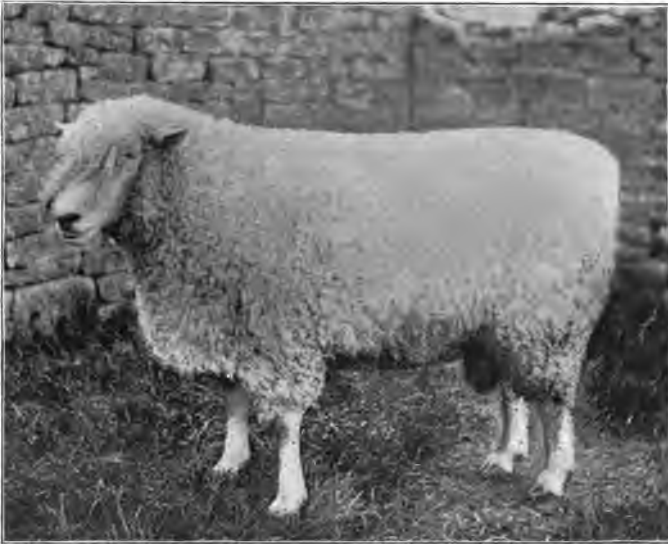


FIG. 25.--COTSWOLD RAM. Bred by and the property of Robert Garne, Aldsworth, Gloucestershire. Winner of first prize at the "Royal" Show, Plymouth, 1890.

They mature early, and, with fair treatment, at twelve months old will weigh over 100 lbs. carcase weight, while the wool clip may be put at 9 to 10 lbs.

They are much in demand for crossing purposes, and the rams, when put to the Suffolk or other Black-faced Down ewes, produce large, early-maturing stock, much in favour with farmers and butchers.

ROSCOMMON.

Native of a limestone country, this breed is an exceptionally strong-boned, large-framed sheep, carrying a good covering of long staple wool. Although the Roscommon rams are much in favour in the West of Ireland for crossing



FIG. 26.—ROSCOMMON RAM, "ADAMANT No. 2," in Flock Book, vol. i. Bred by and the property of Mathew Flanagan, Tulsak, County Roscommon. Prize-winner each year at the Royal Dublin Society's Show, and scaled 31 stones 4 lbs. (434 lbs.) in August 1897.

purposes, the breed has lately been losing ground in the fat markets, as butchers find the joints large and somewhat unsaleable.

The average carcase weight of a two-shear wether may be put at 100 lbs., and the fleece at 10 lbs.

BREEDS OF SHORT-WOOLLED SHEEP.

SOUTHDOWN.

The Southdown breed has been claimed as having been the origin of all the many breeds of Down sheep spread throughout and forming the larger proportion of the entire sheep stock in the southern portion of Great Britain.

Rather small in size but beautifully shaped, a newly clipped well-fed two-year old Southdown is one of the most perfectly proportioned animals of the sheep kind.

The wool is short, close, and fine, covering the whole of

the body and the greater part of the head, and the carcass, when cut up, has a larger proportion of finely grained, juicy meat than is to be found in any other breed.

While this is so under ordinary circumstances, the breed is not considered an early-maturing one, although it is in a special degree suited for gathering its living on the short, rather weak herbage of its native soils.

At two years old the average Southdown will weigh 70 to 90 lbs., and clip about 6 lbs. of wool.



FIG. 27.—SHROPSHIRE RAM. Bred by and the property of J. Lennox Naper, Longherew, Oldcastle, County Meath. Winner of first prize at the Royal Dublin Society's Sheep Show, 1896. (*From a Photograph by Lafayette, Dublin.*)

SHROPSHIRE.

Although what may be termed a newer breed than the Southdown, the Shropshire sheep have been spread abroad throughout the world in a significant way. The high favour in which these sheep are held by sheep-owners is doubtless due to the fact that, as profitable farm stock, the Shropshires adapt themselves to the varied circumstances under which sheep-farming is pursued at home and abroad.



FIG. 28.—SUFFOLK EWES (prize-winners). Bred by and the property of Joseph Smith, The Grange, Walton, Suffolk.

Although a short-woolled breed, they have a larger frame than the Southdown, while the texture of their mutton bears a strong resemblance to what may be termed the original Down.

A well-fed shearling Shropshire sheep will weigh from 70 to 80 lbs. carcase weight, and clip 8 lbs. of wool.



FIG. 29.—HAMPSHIRE RAM. Bred by and the property of Lord Rothschild, Tring Park, Herts. Winner of first prize at the "Royal" Shows in 1896 and 1897.

SUFFOLK DOWN.

The Suffolk Down is well adapted for the extremely poor, light land pastures to be met with in its native county.

It has a jet-black face, is hornless, and in many respects, both in its wool and mutton, resembles the Hampshire Down. The ewes are looked upon as good milkers, and, when crossed with some of the larger-sized white-faced rams, produce and rear fat lambs much in favour with the butchers.

A great improvement has taken place in this breed during the past ten years, and this is in a great measure due to the fact that flock-owners have, through prizes and other means, encouraged their shepherds to be observant and careful.

The carcase weight of two-shear sheep of the Suffolk breed may be put at 80 lbs., and the fleece at about 6 lbs.



FIG. 30.—OXFORD DOWN RAM. Bred by and the property of John Treadwell, Aylesbury, Bucks. A famous prize-winner.

HAMPSHIRE DOWN.

As has been said, the Hampshires and the Suffolk Downs are very similar in many respects. The head, however, of the Hampshires may be said to be its peculiarity, seeing it is—compared with other breeds—large in proportion to its body. These sheep are noted for the amount of lean meat they carry, and on this account, although large in the bone, they are favourites with the butchers.

7 lbs. may be put as the weight of wool, and 80 lbs. as the average carcase weight of a shearling Hampshire Down.

OXFORD DOWN.

This early-maturing breed is said to have been produced by crossing the Hampshire Down with one or other of the heavy-woolled white-faced breeds. This breed has gained much favour with arable land farmers of late years, and high prices are realised by breeders in England for rams sold at their annual sales in autumn.

85 lbs. may be put as the carcase weight of a shearling, and wool 9 lbs.

DORSET.

The Dorset is a soft-woolled, white-faced, horned sheep, which has long been bred in the South-West of England. Of late years the breed has spread greatly on account of the ewes being suitable as mothers of early lambs, seeing that they may be mated to produce lambs in November, December, or January. In some cases they rear two crops of lambs in one year.

Their carcase weight as two-shears may be put at 70 lbs., and the wool at 5 lbs.

MOUNTAIN SHEEP.

CHEVIOT.

The Cheviot is a white-faced, hornless breed, much thought of in the high-lying districts in the Border districts, and many of the northern parts of Great Britain, where hardship and exposure must necessarily be the lot of sheep grazed and fed on those bleak pastures. The wool of this breed is of a peculiar soft texture, growing closely and evenly over a carcase full of lean-fleshed mutton. Like all other mountain breeds, the Cheviots are easily disturbed, and in consequence are less suited than many of the more domesticated breeds for such systems of sheep management as are practised in the south-east, and south of England. Their semi-wild instincts, however, render them well suited for their life on the lonely open pastures of their native soil, more especially the strong homing propensity, which tends much to restrain them from wandering far from their own ground.

The ewes are good milkers and careful mothers, and

when crossed with rams of an early-maturing breed, they produce and rear strong healthy lambs much in favour with arable land farmers in the northern portion of the kingdom.



FIG. 31.—CHEVIOT RAM, "LORD PERCY." Bred by and the property of John Elliot, Hindhope, Jedburgh. Winner of first prize at the Highland and Agricultural Society's Show, Glasgow, 1897. (From the "*North British Agriculturist*,".)

The clip of wool of this breed may be put at about 4 lbs., and the average carcase weight of a two-year sheep at 50 lbs.

BLACK-FACED MOUNTAIN SHEEP.

These sheep are peculiarly adapted for their life on the high mountains of Britain, where they gain a livelihood under circumstances of a very trying nature.



FIG. 32.—BLACK-FACED MOUNTAIN RAM. Bred by and the property of J. Archibald, Overshiels, Stow, N.B. Sold at a public sale for £150, the highest-priced ram of the breed. (*From the "North British Agriculturist."*)

Much attention has of late years been given to the improvement of this breed, and through careful selection and attention to the development of its many naturally

valuable qualifications, its mutton and wool-producing powers have been largely increased.

Sheep of this breed, when reared to maturity on the mountains, and afterwards fattened on the richer lands of the low country, are much liked by butchers; the better-class meat vendors in Edinburgh and Glasgow take a pride in supplying their customers with what they term "black-faced mutton."

The ewes of this breed are much sought after for crossing with Border Leicester rams, the produce in many districts being spoken of as "cross-breds," while the Leicester and Cheviot are termed "half-breds."

The clip of the Black-faced Mountain sheep may be put at 3 lbs., and the carcass weight of a well-fed three-year old sheep at 60 lbs.

CHAPTER VII

PIGS

Common mismanagement of pigs—Condition of the pig-house—The three varieties of pigs. (1) **WHITE PIGS** :—Large, middle, and small. (2) **BLACK PIGS** :—Berkshire and Suffolk pigs. (3) **BROWN OR TAWNY PIGS** :—The Tamworth varieties. **CROSS-BREDS** :—The “Sandy-Spotted Improved.”

IN Ireland the pig has been termed the “gentleman that pays the rent,” while in the country districts of England and Scotland the small farmers and cottagers depend upon the pig, or the money received for him, for many of the comforts of life. While this will be readily acknowledged, it must be said that the breeding and care of pigs too often receive scant attention.

Pigs are to be seen confined in cold, draughty, abominably dirty buildings, and are fed in troughs filthy and disagreeable in the extreme; it never seems to occur to their owners that this behaviour is thriftless, and even inhumane. Dire necessity drives the poor animals to unclean ways, and, when seen grubbing amongst filth for their sustenance, they are looked upon by their careless and neglectful owners as dirty “in manner born.” If, however, attention be given to the animal's comfort and natural disposition, it will at once be evident that a pig can be and will be fastidious, and in the exercise of such fastidiousness there is much profit to the owner.

Condition of the Pig-house.—A pig-house ought to be wind and weather proof, and so arranged that the bed may be dry and warm. To secure the first qualification, the inside of the pig-house ought to be on a higher elevation than the outside yard, while the area both inside and out should be either laid in concrete or paved with bricks or stones. If paved with stones, these ought to be laid closely together so as to form an even surface, the joints being well filled with concrete, lime, clay, or sand. The door leading to the small yard or open space, which ought to be attached to all houses specially built for pigs, should,

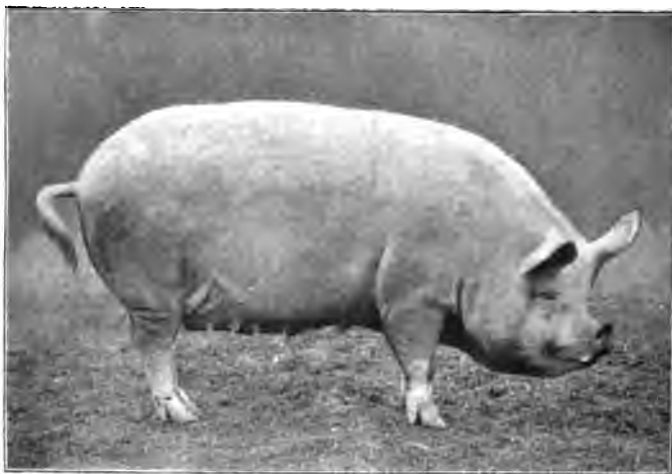


FIG. 33.—LARGE WHITE SOW. Bred by and the property of Sanders Spencer, Holywell Manor, St. Ives. Winner of many first prizes.



FIG. 34.—MIDDLE WHITE SOW. Bred by and the property of Sanders Spencer, Holywell Manor, St. Ives. Winner of many first prizes and cups.

if possible, face the mid-day sun, and, although high enough to admit a man to enter, ought to be so constructed that the upper portion could remain closed as a protection from cold winds or bright sunshine, and thus render the building comfortable at all seasons of the year. The outside space attached to a pig-house intended for one, two, or three feeding pigs, or a single breeding sow, ought to be at least ten feet square, so that the feeding-



FIG. 35.—SMALL WHITE SOW. Bred by and the property of Sanders Spencer, Holywell Manor, St. Ives. Winner of eleven first prizes.

trough may be at some distance from the corner in which it will be found that the dung is deposited. These deposits ought to be removed and the small yard swept clean at least once a day. If this is attended to, the litter will seldom have to be renewed, and indeed in the warm season litter may be dispensed with.

The feeding-trough is often a weak point in an otherwise well arranged pig-sty. In the first place, it ought to be so arranged that the pigs cannot step into it when



FIG. 36.—BERKSHIRE BOAR, "LORD RUBY." The property of Mr. J. Pittman King, North Stoke, Wallingford. Winner of first prize, Royal Agricultural Society's Show, Manchester, 1897; first prize, Oxfordshire Show, Banbury, 1897; and champion boar of any breed. (*From the "Live-Stock Journal."*)

feeding, and, if it has to do service for more than one pig, care ought to be taken that each and all get a similar chance of the food supplied. There are several cleverly constructed metal troughs, but as these may not at all times be available, a wooden one, constructed on such a plan as will prevent the animals while feeding getting their feet into it, can be made by any one who may have a few deal boards, a saw, a plane, a hammer, and nails.

Varieties of Pigs.—Pigs may be roughly divided into three varieties—White, Black, and Brown or Tawny.

There are three subsections of **White** pigs—Large, Middle, and Small.

The Blacks.—These include the Berkshire and Suffolk varieties.

The Tamworth Pig (Tawny Coloured).

Along with these are to be met with all conceivable mixtures or crosses of two or more of the above breeds.

The Large White, or what is termed the Large Yorkshire, is much in favour in the North of England, and is a fast-growing, good, general-purpose animal. In those districts where the tastes of the pork-consumers lead to the slaughter of young pigs, the Large White asserts its supremacy. Killed at the age of six or eight months, these pigs "die" a useful carcase of nicely mixed lean and fat. If well fed and allowed to grow to full size, the bacon portion of the carcase of a Large White pig becomes over-fat for the present-day requirements. A mild-cured ham of a pig of the large-sized breed, such a ham as one may find cooked and placed on a market dinner-table in Yorkshire, Cumberland, or Westmoreland, may well be spoken of as a luxury. Compared with the pickled, flavourless, maize-fed American production, it is as different as it is possible to imagine.

The Large White breed ought to be long in the body, wide and straight along the back, and full, deep, and thick through the hams. The head ought to be moderately short, with ears set wide apart and tending forward, but not drooping. The hair ought to be fine and thin. Coarse thick hair is looked upon with disfavour, although locality and the temperature of the houses in which the animals are kept have much to do with the growth and quality of the hair of pigs.

The Middle White needs no further description than



FIG. 37.—TAMWORTH SOW, "WHITEACRE COUNTESS 2ND" (7832). The property of Mr. D. W. Philips.
First prize and champion Tamworth, Royal Counties Show, 1897. (From the "*Live-Stock Journal*.")

that it is of a smaller size than the Large White, and being shorter in the body, it looks thicker and wider.

The **Small White** is principally valuable as a pork-pig to be slaughtered young. If allowed to grow to maturity, its sides or bacon portions are wanting in lean flesh. Fanciers of the Middle and Small breeds give much attention to the heads of their favourites, and short jaws and rather turned-up snouts are looked upon as indications of purity.

In speaking of the two latter White breeds, it may be stated that, if allowed to mature, they cut up as over-fat carcasses; but when it is remembered that for many of our large centres of population the butchers prefer well-fed young pigs to more matured animals, the value of these quick-growing porkers can readily be understood. In the London markets, for instance, there is a great demand for well-fed pigs, to weigh when dressed from 60 to 100 lbs., and at certain seasons of the year "milk-fed porkers," to weigh when dressed 40 to 60 lbs., command a high price. The flesh of a milk-fed porker is white and delicate, and the carcase of a pig belonging to any of the three White breeds, with its thin tender skin, is most suitable for cutting up into roasting joints.

The **Berkshires** are generally acknowledged to be hardy and prolific. They are all black, with a narrow white blaze on the face, four white feet, and a small amount of white on the tip of the tail.

These and other black breeds are credited with having a large proportion of lean flesh, and are much in favour for their plump, well-shaped hams, and thick, good sides, or bacon flitches.

The **Tamworth**, a brown or tawny-coloured breed, has come greatly into favour of late years, and these animals have many good qualifications. They are not so wide in their ribs as the Berkshires and Whites, but they have long deep sides, and breeders of this variety hold that, weight for weight, there is more lean flesh in the Tamworth than even in a Berkshire or Black Suffolk.

A cross between the Berkshire and the Tamworth is a favourite pig among many feeders, while it is also liked by the butchers and bacon-curers. As a rule, these pigs are in colour a black and tawny mixture, and have by some been named "the Sandy-spotted Improved."



FIG. 38.—PEN OF LIGHT-COLOURED BRAHMAS. Winners of first prizes and specials.

CHAPTER VIII

POULTRY

Poultry-keeping an important industry—Care and attention to the comfort of fowls necessary. **THE SELECTION OF POULTRY**:—Useful breeds for (a) general purposes, (b) specially for laying—Crossing with game birds; its object. **DUCKS**:—The rearing of ducklings—Varieties. **GEESE**:—Varieties. **TURKEYS**:—Attention necessary—Varieties.¹

Importance of the Poultry-Breeding Industry.—Amongst the smaller industries which ought to receive attention from the farmer, that of poultry-keeping deserves a prominent place.

The enormous consumption of eggs in our large towns far exceeds the home supply, and it is continually being said that the millions annually paid for foreign eggs ought to go into the pockets of home-farmers. Much is being done to arouse interest in this matter, but, as a rule, it is greatly neglected, and the care of the poultry on a farm is generally left to the female portion of the household, without proper arrangements having been made either for breeding, feeding, or sheltering the stock.

In many cases, any sort of rough and tumble-down house is thought good enough for the poultry, and, indeed, on many farms the fowls are allowed to find for themselves, to roost in odd corners, and generally treated as trespassers wherever they may be found by the male members of the family. Such being the state of matters, the birds are in a semi-wild condition, breeding at random, and altogether little calculated to be the pecuniary help they might be on many a holding.

Care and Attention Necessary to Success.—One of

¹ All the illustrations in this chapter are taken from photographs of prize-winning birds, the property of R. G. Nash, Esq., Finnstown House, Lucan, Co. Dublin.



FIG. 39.—SILVER DORKING COCK. Winner of first prizes and specials.



FIG. 40.—COLOURED DORKING HEN. Winner of cups, first prizes, specials, and medals.

the first principles that ought to be impressed upon every owner of poultry, and farmers more especially, seeing they have all the elements of success within their reach, is **the absolute necessity of attention to the comfort of the fowls**. No matter what breeds are kept, unless care and thought are bestowed on their feeding and housing, success need not be looked for. In many a farmyard, instead of being set down, as it often is, in a cold, exposed and sunless position, the hen-house might just as easily have been situated in a sunny, sheltered corner, or have formed part of the main buildings, between two of the cattle-houses, where the temperature during the cold season, when the cattle are indoors, would be altogether different from that of an outside building.

Then, again, it ought to be firmly impressed upon every member of the farmer's family and household, that, as fowls are valuable property, anything like harsh treatment or conduct likely to frighten the birds must be at once repressed. In a farmyard, hens ought to be educated so that they may get beyond the wild instinct of laying away in odd, out-of-the-way corners, and the first principle in the education spoken of is to make it a rule to treat the birds so that they become tame. A poultry-keeper who, without hurry or excitement, feeds and tends the birds in a regular and methodical way, will very soon gain their confidence and be able to control them in many ways. It is interesting to see a hen mother with her chicks around her, allowing a quiet careful attendant to handle them, drive them about and otherwise direct them, when a stranger would at once be resented, were he to attempt the smallest liberty with the brood.

SELECTION OF POULTRY.

Much of the profit of the business of poultry-keeping, whether for egg-production or chicken-rearing, depends upon the careful selection of birds and breeds most likely to answer the purpose in view. It must however be acknowledged that poultry shows, as at present conducted, do little to assist the great class of poultry owners



FIG. 41.—LIGHT-COLOURED BRAHMA COCK AND HEN.
Winners of first prizes and specials.



FIG. 42.—LANGSHAN COCK AND HEN.
Winners of cups, first prizes, and specials.



FIG. 43.—HOUDAN HEN. Winner of cups, first prizes, and specials.

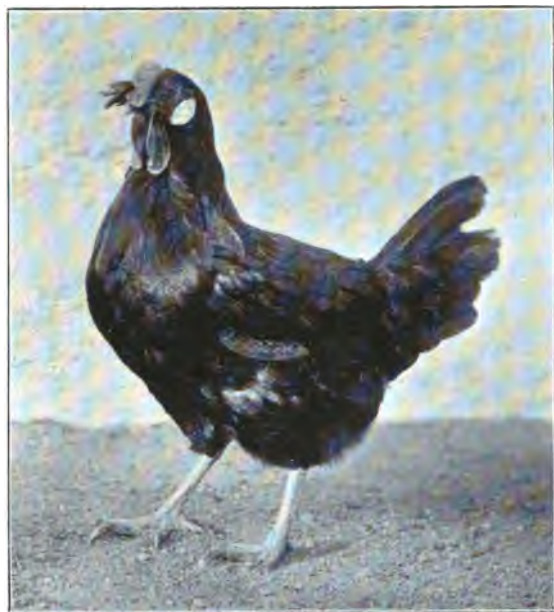


FIG. 44.—MINORCA HEN. Winner of cups, first prizes, and specials.

in the matter of improvement of our fowls. The "fancy" has taken too much hold of the business, and attention has been devoted to the production of birds having certain well-defined characteristics in the matter of colour and feather, while unfortunately, in most instances, their practical utility has not received the same careful attention.

Leading Varieties of Poultry.—The following list comprises useful breeds, suitable for farm rearing:—

- | | |
|---------------------------------|---|
| (A.) For general purposes . . . | Dorkings (Figs. 39 and 40).
Cochins.
Brahmas (Figs. 38 and 41).
Langshan (Fig. 42).
Plymouth Rocks.
Houdan (Fig. 43).
Wyandottes. |
| (B.) Specially for laying . . . | Andalusians.
Hamburgs.
Leghorns (Fig. 45).
Minorcas (Fig. 44). |

Crossing Game.—Game, more especially the Indian game, is largely used for crossing purposes to develop depth of flesh on the breasts of fowls intended for the table. The accompanying illustration of a Game Bantam shows the breast development peculiar to the game breeds (Fig. 46).

While there are many other breeds, each having keen supporters, the above list (as also those of ducks, geese, and turkeys which follow) includes such as have been proved by practical experience in different climates to be highly useful as farmyard fowls. Few farmers, unless peculiarly situated, care to breed and own other than general-purpose fowls, and consequently they aim at producing a stock of hens to lay a fairly large number of eggs, and yet, at the same time, rear chickens of sufficient size and quality to rank as good table birds.

A common stock of hens may be quickly improved and graded up through good male birds being introduced into the flock, and it may be safely said that the male Dorking is one of the most useful and successful for this purpose. Many careful and successful farmyard poultry owners make it a rule to bring into their flock pure-bred



FIG. 45a.—WHITE LEGHORN COCK. A first prize winner.



FIG. 45b.—WHITE LEGHORN HEN. Winner of several first prizes and specials.

male birds at least every second year, and, while the Dorking is largely used, occasionally the Game, Langshan, and Minorca, and other breeds are resorted to, with the result that the birds are large, full-breasted table fowls, and at the same time good layers.

Such a system of breeding may not recommend itself to breed fanciers, but, as stock for a farmyard, where utility is kept in view, practical experience has shown that cross-bred fowls are stronger and more profitable than any of the pure breeds.

DUCKS.

If opportunity occurs, ducks will spend much of their time in water, but they may be successfully bred and reared where the only accessible water is that contained in drinking-vessels so constructed that the birds cannot enter them. Indeed, in the profitable feeding of ducklings, they are not allowed the opportunity of spending their time in water, where their natural instinct induces them to take a great amount of exercise, tending much to retard the fattening process and to render their flesh hard and tough. In practice it will be found that hens make good foster-mothers to hatch the young ducks, and when two or three broods are hatched about the same time, they may be put together under the care of one hen-mother. In rearing ducklings, it is most important that they be kept under cover during the night, on a dry warm floor, and with this they will be quite independent of their foster-mother's care. A well-bred, well-fed duckling will, at the age of three months, weigh five to six pounds, and will always command a ready sale.

The principal breeds of ducks are :—

Aylesbury.

Pekin.

Rouen (Fig. 47).



FIG. 46.—BLACK RED GAME BANTAM. Winner of cups, first prizes, and medals, and several specials for the best Bantam exhibited, also for the best bird in the Show.



FIG. 47.—ROUEN DUCK. Winner of cups, first prizes, and specials.

GEESE.

Although geese are kept on many carefully cultivated farms, the great majority are bred and reared by cottagers and others, and in such cases the birds gather their food on



FIG. 48.—TOULOUSE GANDER AND GOOSE (hatched 1897). Gander first prize and special at Crystal Palace, and first at Royal Dublin Society's Show.

the sides of roadways or other spare corners of grass land. Large numbers of geese are bred on open common lands and moors, and when about half-grown, are bought by farmers having arable land, to act as field-gleaners after the corn crops have been gathered.

When full grown, a few weeks' careful feeding will be sufficient to bring a well-bred gosling to weigh, when dressed, 8 to 10 lbs.

Varieties of Geese recommended are :—

Emden.

Toulouse (Fig. 48).

TURKEYS.

These birds, though strong and hardy looking, are in the earlier stages of their growth generally considered trouble-

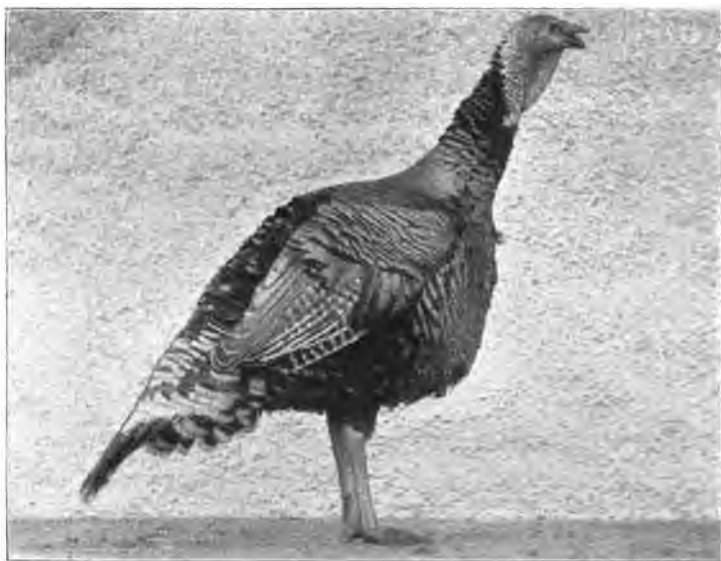


FIG. 49.—AMERICAN BRONZE TURKEY COCK. Winner of first and special prizes at the Crystal Palace, and first special prize and cup at the Royal Dublin Society's Show.

some and difficult to rear. Turkeys thrive best on a dry, warm soil, and much of the trouble experienced by breeders through the apparent delicacy of the birds is due to the damp or wet soil on which it is attempted to rear them.

All breeds of turkeys have a strong tendency to revert to their naturally wild habits, and, whenever it is possible to do so, those birds that are managed under a system consistent with this wild instinct will be found prolific and hardy. Placed in a thickly-planted patch of young timber growing on a dry, light, or gravelly soil, and protected from foxes and other vermin by means of wire netting or fencing, turkeys, if regularly fed, may be left entirely to their own resources to breed and rear their young till such time as they are strong enough to be taken from the breeding ground and fattened for the market. Spring-hatched gobblers, if well bred and carefully fed, should weigh in December 15 to 20 lbs. dressed, the value per pound increasing with the weight.

Suitable varieties of Turkeys are—

American bronze (Fig. 49).

Black Norfolk.

Cambridge.

CHAPTER IX

HORSES

Selection of horses in relation to the nature of the work to be done—
Importance of soundness in horses intended for breeding purposes—
Various causes of unsoundness—"Side-bones"—"Wind" affections
—Formation of the feet and leg-bones. BREEDS OF HEAVY
HORSES:—The Shire—The Clydesdale—The Suffolk Punch—The
rearing of foals—Shedding of teeth—The training or breaking of
young horses—General treatment of working horses.

To enter upon any extended treatise upon horses is quite beyond the province of this work. In fact, the horse only figures in these pages so far as he contributes, in an indirect way, to the production of food, and this being so, he need only be considered as a means towards an end. It may be here stated, that although the horse is a necessity upon all farms, his almost universal use as a motive power in ploughing, harrowing, and such like field-labour, might with profit be taken in many cases by the ox. This, however, has been dealt with in the chapter on Cattle.

Selection of Horses in Relation to the Nature of the Work to be done.—Restricting our observations regarding horses to the class necessary for performing the work upon the farm, there are several considerations which ought to receive attention. In the first place, a farmer has to determine the class of horse he ought to keep, and in this he should be guided entirely by the surrounding circumstances. In farming heavy soils, it is necessary to have strong, powerful horses, if the work of ploughing and cultivating the soil is to be satisfactorily done. Upon most farms it will be found that the work can be performed by breeding mares and young horses, and many farmers make horse-breeding a profitable business by arranging to have a relay of young horses to take in hand every year, with a similar number of matured, seasoned horses to be sold off. In the British Isles, and even in new countries, there is always a demand for strong young animals from five to eight years of age, to go into the cities and towns as dray-horses.



FIG. 50.—SHIRE STALLION, "ROKEBY HAROLD" (15.315). The property of Lord Belper. First prize and champion at London, the "Royal," and other shows. (Reproduced by permission of the Shire Horse Society. Photographed by Charles Reid, Wishaw.)



FIG. 51.—CLYDESDALE STALLION, "MACGREGOR" (1487). Foaled 1878. The property of Andrew Montgomery, Netherhall, Castle Douglas, N.B. A famous prize-winner and notable sire. (*From the "North British Agriculturist."*)

Importance of Soundness in Horses used for Breeding Purposes.—If, while obliged to keep a certain number of horses for the cultivation of the soil and other work of the farm, it is determined to make the farm self-sustaining, and, if possible, to realise an income from the sale of matured horses, it is of the utmost importance that the breeding animals should be sound and free from hereditary diseases. Two of the most common causes of unsoundness in heavy horses are “side-bones” and the different forms of “wind” affections. It is no part of this work to enter upon the many causes of unsoundness in horses, but the two spoken of, being easily detected, ought to be carefully avoided in all breeding stocks.

“**Side-Bones**” may be described as a hardening of the cartilaginous membrane round the coronet of the hoofs, generally on the outside of the fore-feet. The presence of side-bones can be easily recognised by pressing the coronets of the hoofs, when, if present, these will resist the pressure, and feel as if the hoof-tops were joined to the bones of the leg by an unyielding substance.

“**Wind**” **Affections.**—One of the characteristics of a horse held to be unsound in his wind is the tendency he has to grunt when suddenly threatened with a stick, and again another, and perhaps more reliable test, is to apply the ear near his nostrils after the horse has galloped on soft soil, or has been made to pull a heavy load at a smart pace, when a wheezing noise will be heard if there is any wind affection.

Formation of the Feet and Leg-Bones.—The bigger and heavier a horse may be, the more attention ought to be given to the formation and quality of his feet. However good he may be otherwise, a heavy horse with badly-formed, brittle, or small feet can never be expected to keep sound when put to work upon paved or macadamised roads.

Flat, hard, well-formed leg-bones are of much more importance than mere size of bone, and the junction of the leg and the foot, the pastern, ought to be set at an angle of about forty-five degrees. Upright pasterns denote navicular troubles, while greatly elongated pasterns, as a rule, indicate weak joints.

Breeds of Heavy Horses.—There are in Great Britain three breeds of heavy horses, each of which has keen

supporters, although in two of the most widely known breeds there was, until late years, much mixing up and blood relationship.

The **Shire**, or English cart-horse (Fig. 50), and the **Clydesdale**, or Scotch cart-horse (Fig. 51), have each a stud-book, and the better-class animals of either of these breeds are wonderful examples of what care and attention can do in producing draught horses fit to move heavy loads and stand the wear and tear of our hard streets.

The **Suffolk Punch** horses are deep-bodied, clean-legged animals, much in favour in their native county; but they have not spread much throughout the country, nor indeed been taken up by exporters and foreign buyers to the same extent as the breeds first mentioned.

If a farmer means to breed his own horses, let the breed be what it may, he ought to begin by selecting his mares with care, and if possible have them inspected and passed as sound by a qualified veterinary surgeon. The selection of the stallion, it is needless to say, is all-important, and nothing should induce a breeder to mate his mares with an unsound horse. The certainty of direct transmission from sire to produce of the common and damaging diseases attacking the wind, legs, or feet of horses ought to deter any one who intends to breed animals for sale from using, as sires, such horses as may even be suspected of showing symptoms of these diseases.

At the present day, in England, a sound five-year old cart-horse of size sufficient to form one of a team of London or Liverpool lorry-horses, is worth any price from £60 to £100, according to his weight and looks, while one of similar conformation, but with "knobs" (side-bones), or affected in his wind, has to be sold for from £20 to £30.

The Rearing of Foals.—In rearing young horses, or indeed all young animals on the farm, it is of the highest importance to see that, after being weaned, the animals are not allowed to lose flesh or get into poor condition. Foals for the first year, after being taken from their dams, ought to be well fed, so as to get a start in life which they are never likely to forget. A colt or filly, if well fed, and sheltered from the wet and cold till it is eighteen months old, can then be reared on a farm during its second winter at very little expense, seeing that it will then

be able to live and thrive upon inexpensive fodder, such as good oat-straw or rough hay, if the severity of the climate or other circumstances prevent its being wintered out of doors. A cart colt or filly can be taken up at two and a half years of age to do light work, such as light ploughing and harrowing. Attention must, however, be given that the animal is under the care of an observant, humane driver, who will at once detect if any of the harness chafes or injures the skin. Sores caused in this way are apt to irritate the animal, and cause it to develop vicious habits. For a time, until the shoulders get accustomed to the friction of the collar, they are apt to become heated, and, if not attended to, blisters and sores result. Attention ought to be given to keeping the lining of the collar clean, and, for a time at least, the use of a light mat collar often saves trouble in this direction.

Shedding of Teeth.—Between three and four years of age, when horses are shedding their teeth, they are apt to lose flesh through their inability to masticate their food. Should an animal show an indication of refusing its food, or become what is termed a “shy” feeder, the state of its teeth ought to be looked to, and in many cases its attendant, with the help of an ordinary forceps or pincers, can at once remove the loose teeth which have been the cause of the trouble. It may be necessary in some cases to apply to the veterinary surgeon, who can do much to relieve the animal when its teeth are being irregularly shed. It need hardly be said that attention to the sanitary condition of the stable and its proper ventilation is all-important.

The Training or Breaking of Young Horses.—With regard to the training or “breaking” of young farm-horses, it is interesting to note the different systems practised in different parts of the British Isles. In some districts the process of training or breaking extends over a period of several weeks, while in others it is carried through in a few days. No doubt the treatment the animal may have received during its early life has much to do with this, and one that has been accustomed to be led and handled as a foal and during its colthood will have acquired an amount of confidence in man which is altogether wanting in youngsters that have been rarely handled. Be this as it may, we find the young farm-horse in some districts, after

having been accustomed to have a bit in his mouth, at once placed alongside a trained companion, and taught to draw a light weight. In other districts he is what is termed "mouthed," led about with a large bit in his mouth, paraded on the roads and fields with his head strapped up, and altogether receives a course of training extending over several weeks before he is considered fit to be harnessed for work.

Judging by results as witnessed under the different systems, it may safely be said that training for work ought to begin at the time the animal is weaned, and, with careful handling during its early life, a young farm-horse will be found to be ready to be put to work whenever its owner may see fit to do so.

General Treatment of Working-Horses.—In many parts of the country, farm-horses are fed during the winter on straw and roots with a small daily allowance of oats. In summer they are either turned into the grass-fields during their spare hours, or are fed on green food in the stables or yards.

In several counties of England the working horses are on many farms kept in open yards instead of stables, and consequently in winter they carry thick coats of hair. This must operate against their working powers, as there is much truth in the old saying that "good grooming makes a horse fit and saves much food."

A young horse, well kept and always "above his work," will be at six years old full of courage, and likely at once to catch the buyer's eye, whereas one that has been badly kept and overworked when young seldom throws off the appearance of the drudge or slave.

CHAPTER X

THE DAIRY

THE DAIRY :—Points of a dairy cow—Dairy products and their value—Rearing of calves. **BUTTER-MAKING** :—The churn—The cream separator—Importance of cleanliness and ventilation in the dairy. **CHEESE-MAKING**.

EVERY farmer, let his holding be large or small, has an interest in milk and its products, and of late years there are few matters connected with farming that have received more attention than dairying and dairy produce. That even yet dairying on many farms has not received the attention it deserves, few will question; but when farmers in general are asked to look upon the production of milk as their principal mainstay, practical men must at once see that the theorists who so advise them are being carried away by enthusiasm.

Until lately, the only milk products that could be put upon distant markets were salted butter and cheese; but now, thanks to the spread of scientific knowledge and the increased and improved transit facilities, milk, cream, and fresh butter can be conveyed long distances in a perfectly sweet and fresh condition. Dwellers in British cities are now supplied with these commodities, not only from distant centres at home, but also from many foreign countries. The competition with which dairy-farmers have now to contend has greatly reduced prices, and complaints are loud as to the dairy business being a non-paying one. That it is less profitable than it was some years ago there can be no doubt; but even yet, with milk at present prices, the net return per cow received by dairymen greatly exceeds that obtained by cattle-feeders who devote their attention to beef-production, let the breed and quality of the fattening steer be what it may. The natural effects of this are already apparent in the largely increased number of farmers who are turning their attention to

dairying, and in so doing, in too many cases, they aim at owning cows to serve this one purpose, to the neglect of the animals suitable as general-purpose stock. It is evident that such an extension of dairying must lead to a further reduction of prices, and it must be remembered that on the large majority of farms it would be a mistake to allow other interests to become subservient to this particular one. Granted that this is so, it is none the less necessary that the most should be made of the milk produced on every farm. This can only be done by close attention to details in the breeding, feeding, and general management of cows, together with a careful study of the improved methods of handling milk.

POINTS OF A DAIRY COW.

It has unfortunately been accepted as a general rule that a dairy cow must in all her points be a complete contrast to the beef-producing animal. This theory has been, no doubt, founded upon the fact that many of our breeds of dairy cattle are of the lean kind, being narrow in the chests, fine in their shoulder-joints, hard along their backs, and thin in the thighs. Taking the Jersey cow as an example of the accepted type of a milking animal, it must be remembered that the breed she belongs to has its home at an elevation very little above sea-level, where the atmospheric pressure is great, and where width of chest and lung capacity are less necessary than on land at a higher altitude. Along with this, it must not be forgotten that the Jersey farmers, depending as they did for many years on the export of butter as one of their principal means of living, gave rich milk-production their careful attention, and bred cattle to suit this particular purpose alone. Long before scientists demonstrated that the milk from a Jersey cow held larger fat globules than were commonly found in the milk of other breeds, practical experience had proved to those island-breeders that selection and care in breeding could be safely relied upon to produce an animal to answer their purpose. That this care has long been exercised in Jersey is as well known as that it has been neglected by other breeders; and

there can be no doubt, had the matter received due attention, the richness and quality of the milk in our other breeds might have been developed in a different and higher degree. There seems, therefore, to be no sufficient reason why we should conclude that a high-class dairy cow should be narrow and wedge-shaped, and totally unfitted to produce an animal likely to become a high-class butcher's steer. Indeed, we have only to look at many of our Shorthorn prize-winning animals that are the produce of deep-milking dams, to know that wide chests, wide backs, and full thighs need not be taken as evidence of poor milking qualifications.

This subject has been dealt with at some length, since to the ordinary farmer, whether at home or abroad, a general-purpose cow is infinitely preferable to one likely to answer one purpose and one purpose only. The production of this general-purpose animal ought to be the aim of every farmer, and nothing will assist him so much in this direction as a regularly kept daily record of the weight and quality of milk produced by each cow. This record must necessarily extend over the whole milking period of the year, as it is more important that a cow should give a regular quantity, extending over a lengthened period, than that she should have a great flow for a short time only after calving.

If, therefore, it can be claimed that it is possible to own a class of general-purpose cows, deep-milking, and yet capable of producing calves to grow and feed into high-class beef animals, let us consider from a practical point of view what any ordinary farmer can do in the matter of dairy products.

DAIRY PRODUCTS AND THEIR VALUE—REARING OF CALVES.

Let us suppose the case of a farmer with a stock of well-selected, heavy-fleshed cows with good udders; these, at a very reasonable estimate, may be safely counted upon to produce, say, 40 lbs. of milk each per day during the first sixteen weeks after calving, half that quantity during the following twelve weeks, and 5 lbs. per day during the next twelve weeks. It need hardly be said that, while the gross quantity per cow is given as an estimate of what

may be reasonably looked for from such cows as farmers ought to keep, there is no intention to assert that the quantities put against each of the terms of weeks must necessarily correspond with the figures given. In every herd it will be found there is much variation in cows as to the length of time over which their season's milk-record has to be spread.

Further, let us suppose that these cows produce calves by a good well-bred bull of a "general purpose" breed. These calves, for four weeks after birth, ought to be fed entirely on new milk fresh from the cows, receiving in round figures 30 lbs. each per day, so that for the first month there would be a surplus of 10 lbs. of milk per cow after feeding the calves. During the second four weeks each calf ought to be allowed 20 lbs. of new milk per day, and, in addition, a small amount of some cheaper, but now quite suitable food. This would allow a daily surplus of milk during the second four weeks of 20 lbs. per cow. After the second month, the calves need no longer be fed on new milk, although in practice it will be found that they ought to be served at the same regular intervals at which new milk had been given, with a cheap substitute, such as skimmed milk along with thin gruel made from linseed, meals, or other fat-forming foods. This being so, for the next eight weeks 40 lbs. of milk from each cow would be daily brought into the dairy, and for the twelve following weeks 30 lbs. per day, with the addition of 5 lbs. per day for the following twelve weeks. The season's milk from one cow would thus amount to 6020 lbs., or in round numbers, 600 gallons; this quantity at 4d. per gallon gives £10 as the value of one cow's milk, after deducting from the gross quantity given the amount of new milk needed to rear her calf. New milk may be said to be absolutely necessary in the profitable feeding of young calves, if the stock are expected to grow into full-fleshed animals. Any lengthened feeding with new milk, however, in these days may be dispensed with, as there are many less expensive substitutes now available. These are quite capable of maintaining well-bred young stock in such good condition as that they will retain their natural flesh and develop into high-class store cattle. To the credit of a well-selected cow can therefore be annually placed a valuable calf,

and milk to the money value of £10. It will be observed that the milk has purposely been put at the low figure of 4d. per gallon; it ought to be worth this price upon a farm, even if, on account of remote situation and other causes, milk-selling might be altogether out of the question.

If we put the cream of three gallons of milk as the quantity necessary to produce one pound of butter, valued at 8d. per pound, we find that a cow's milk as above gives a butter return of £6, 13s. 4d. To this has to be added the value of the skimmed milk, worth, for home consumption, at least 2d. per gallon, or £5 per milking season—in all, £11, 13s. 4d. per cow, independent of the calf having been reared to the age of six weeks entirely on its mother's milk, and being certainly worth at that age £2.

As the case has been put, a good general-purpose cow, likely to breed a calf to grow into a profitable feeding animal, may be counted upon to supply the dairy, after feeding her calf, with six hundred gallons of milk per annum. After the wants of the household have been supplied there will be a considerable surplus to be disposed of, even where a small number of cows are kept. If this cannot be disposed of as milk, butter or cheese may be made, as these articles have always a ready sale if sufficient care is exercised in their production.

BUTTER AND BUTTER-MAKING.

To ensure success in making butter of a high class, every care must be taken that **rigid cleanliness** is observed in all the operations connected with its production.

In ordinary practice, the milk when brought from the cowhouse is put through a fine sieve or thin muslin cloth, and allowed to stand in shallow basins till the cream is found floating on the top, when it is skimmed off and set aside to "ripen." It is then put into a churn (Fig. 52), and, through the motion set up by the process of churning, butter is produced. Much of the success of butter-making depends upon the knowledge of the length of time cream ought to take to ripen, and, in churning, in the drawing off of the butter-milk immediately the butter grains are formed. If churning is continued after the butter grains

are formed, the butter will become collected in lumps or masses, enclosing a certain amount of butter-milk; it is difficult to get rid of this completely afterwards, and its presence affects both the sweetness of the butter and its keeping powers. Immediately, therefore, the butter grains are formed the churning ought to cease, and the butter-milk should be drawn off through a fine sieve. Water should then be freely used in the churn until the last vestige of the butter-milk has been removed, when the grains may be pressed together to form a clean, sweet lump of butter.

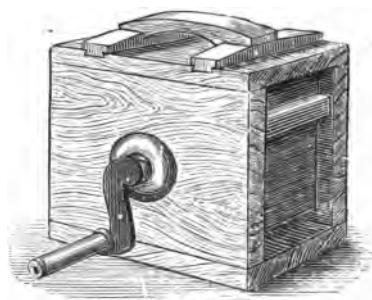


FIG. 52.—CHURN.



FIG. 53.—CREAM-SEPARATOR.

If salt is to be used—and in most cases more or less is added by all butter-makers—it is often dissolved in water and put into the churn, to be drawn off before the butter grains are collected together. This ensures a more even distribution of the salt particles than the older system of applying dry salt after the butter has been collected.

The butter should not be touched by the hands, but should be made up with clean wooden spade-shaped tools. If butter is prepared for immediate sale, a small quantity of salt, say 1 oz. to every 6 lbs., may be used; but if intended to be kept for any length of time, 1 oz. to every 2 lbs. may be put as the ordinary proportions.

The Cream-Separator.—In many dairies the cream is separated from the milk by a mechanical process, which

has many advantages over the system of setting the milk in dishes till the cream rises to the top. The high price of these cream-separators (Fig. 53) has hitherto affected their general use, but every year these machines are being produced more cheaply, and may now be said to be within the reach of small farmers. The "Crown" and "Record" (Fig. 53) separators, made in Stockholm, are about to be placed on the market at very reasonable prices; they are said to be simple in construction and highly efficient.

Importance of Cleanliness in the Dairy.—One of the most important matters connected with the successful production of high-class butter is the careful attention to the condition of the house in which the milk and butter is kept. In practice it will be found to be an advantage to have the dairy so situated as to be sheltered from the mid-day and afternoon sun; at the same time, it must be kept free from damp and properly ventilated. As both milk and butter are liable to be tainted with the smell or flavour of other substances, it is all-important that the apartment in which they are kept is reserved exclusively for them. Such substances as meat, fish, fruits, and vegetables kept in a milk-room are most objectionable.

CHEESE-MAKING.

There are many varieties of cheese, but the principle under which cheese is produced is more or less similar in each case. Rennet, the fourth stomach of a calf, which has been pickled in a strong brine of salt and water, is the agent employed to convert the milk into curd, leaving as a by-product a thin watery substance termed "whey." The whey is drained off, and the curds, after being cut up and salted, are then put into moulds and subjected to pressure until the whole of the whey left after the draining process is removed, when the curds become a solid substance known as cheese. During the pressing process the curds are enclosed in a thin cloth, and this is left on the cheese for a few days after it has been removed from the press and put on a shelf to dry. When the outside, or crust, becomes sufficiently dry, the cloth is removed, and the cheese at intervals carefully turned, so that it may dry evenly and retain its

shape. Much attention must be given, so that the drying process is neither so hastened as to cause the crust to split or crack, nor so delayed as to encourage mould-growth.

Scientists have given the subject much attention of late years, with the result that uniformity of texture, colour, and flavour of the cheese can now be practically assured.

CHAPTER XI

THE FARMER'S IMPLEMENTS

Contrast between the Old Time and the New—Modern implements used in the cultivation of the soil—Modern implements used in harvesting—Illustrative plates.

MUCH as chemists have done for agriculture, engineers and mechanics may be said to have contributed in an equal degree to its advancement.

If we look back, even to the middle of the present century, and consider for a moment the few and comparatively primitive implements available for the cultivation of the land, we are now inclined to wonder at the high state of cultivation of the soil and the perfection of the crops then grown. At the date spoken of, on many well-tilled farms the ordinary swing plough, the common harrow, and the roughly-made stone roller, were almost the only implements at the command of the farmer in the preparation of his land for the reception of the seed. For the harvesting of his crops, he had then just laid aside the hook or sickle, and felt proud to speak regarding the advantages of the scythe. The crops being gathered, they had to be threshed, and the beat of the hand-flail was a sound heard on many a farm.

For the cultivation of the soil, &c., we have to-day

The Wheel Ploughs (Fig. 61).
Chilled Digging Ploughs (Fig. 62).
Double-mould or Ridging Ploughs (Fig. 63).
Grubbers.
Cultivators (Fig. 66).
Zigzag Harrows (Fig. 65).
Clod Crushers.
Cambridge Rollers (Fig. 69).
Corn Drills.
Turnip Sowers (Fig. 70),

and many other improved implements.



FIG. 54.—SPADE.



FIG. 55.—DRAINING SPADE.

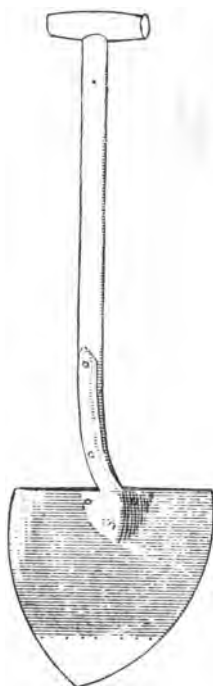


FIG. 56.—SHOVEL.



FIG. 57.—HOE.

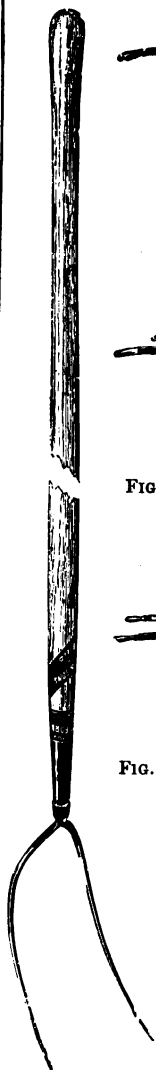


FIG. 58.
HAY FORK.



FIG. 60.—HOWARD'S CHAMPION SWING
PLOUGH, E.B.



FIG. 61.—HOWARD'S LIGHT CHAMPION WHEEL
PLOUGH, S.B.

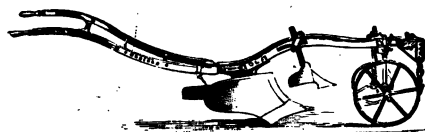


FIG. 62.—HOWARD'S CHILLED-BREAST DIGGING
PLOUGH, P.L.



FIG. 63.—HOWARD'S RIDGING PLOUGH,
L.B. No. 1.

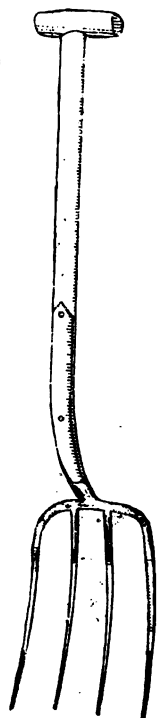


FIG. 59.
DUNG FORK.

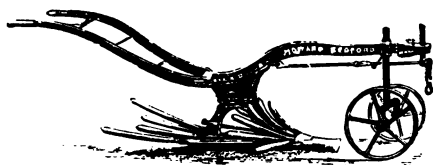


FIG. 64.—HOWARD'S POTATO-DIGGING PLOUGH.

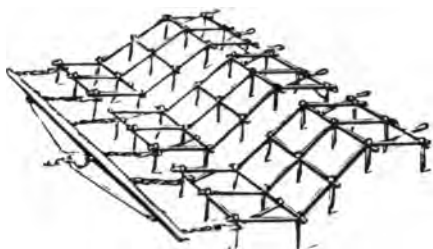


FIG. 65.—HOWARD'S ZIGZAG HARROWS.

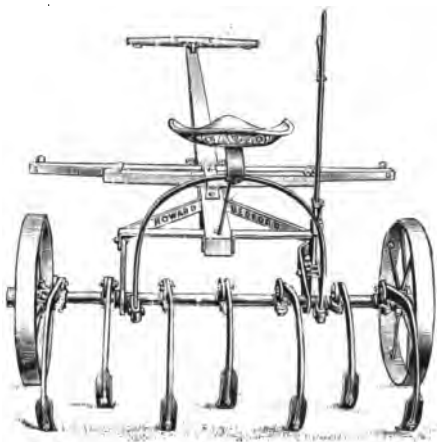


FIG. 66.—HOWARD'S CULTIVATOR, No. 7.

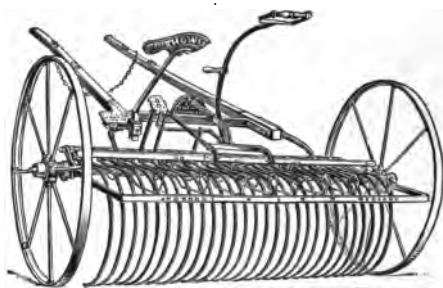


FIG. 67.—HOWARD'S HORSE RAKE, E.L.

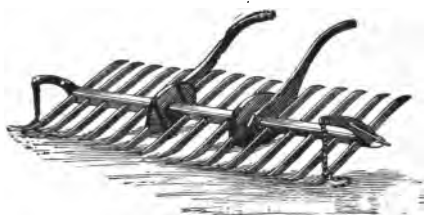


FIG. 68.—HAY GATHERER.

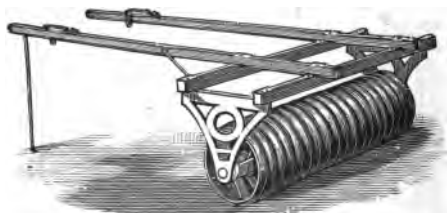


FIG. 69.—CAMBRIDGE ROLLER.

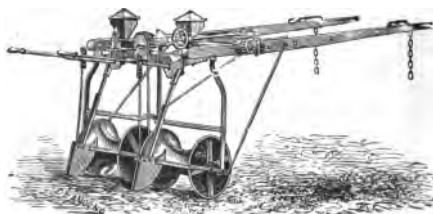


FIG. 70.—TWO-ROW TURNIP SOWER.

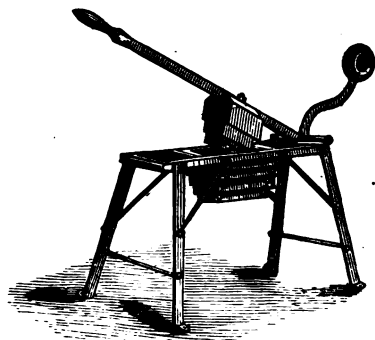


FIG. 71.—TURNIP SLICER.

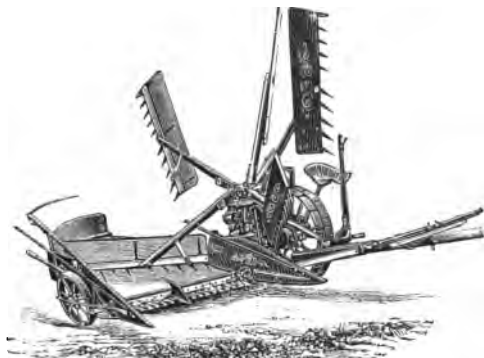


FIG. 72.—HARRISON, MACGREGOR & Co.'s SELF-DELIVERY REAPING MACHINE.

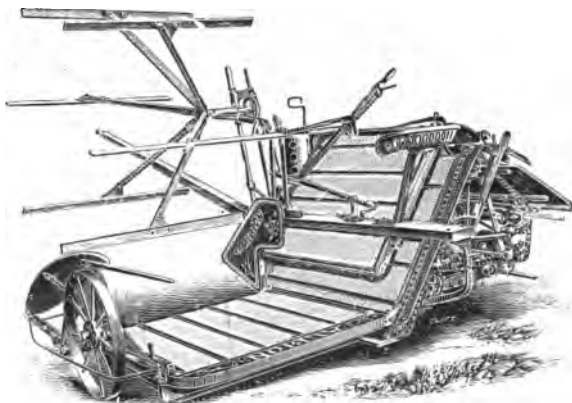
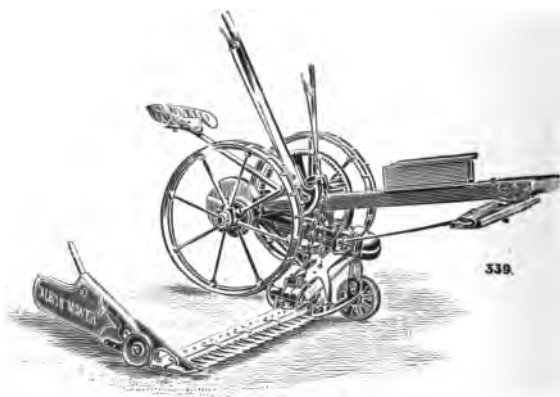


FIG. 73.—HARRISON, MACGREGOR & Co.'s SHEAF-BINDING MACHINE,
"THE ALBION."



**FIG. 74.—HARRISON, MACGREGOR & CO.'S CENTRE-GEAR MACHINE
AS A MOWER.**



**FIG. 75.—HARRISON, MACGREGOR & CO.'S CENTRE-GEAR MACHINE
WHICH CAN BE CONVERTED INTO A MANUAL-DELIVERY REAPER.**

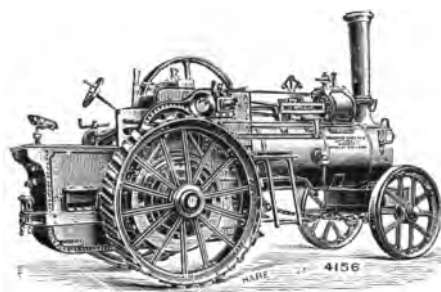


FIG. 76.—RANSOMES, SIMS & JEFFERIES (LIMITED), TRACTION ENGINE
AND THRESHING MACHINE.

For harvesting the crops we have

Mowing Machines (Figs. 67, 68, and 74).
Reaping Machines (Figs. 72 and 75).
Reaping and Binding Machines (Fig. 73).
Potato-Digging Ploughs (Fig. 64).
Potato Diggers.
Turnip Lifters.

The Steam Threshing Machine (Fig. 76), perambulating the country by means of the Traction Engine, not only threshes the grain from the straw, but binds the latter into bundles, and by means of elevators delivers it at various heights to be stacked; while, besides being separated from the straw, the grain is winnowed, dressed, and delivered in sacks ready for the market.

Plates of a few of the most common implements are here given, and may to some extent answer the purpose of detailed explanations regarding the construction of what in many cases must be considered highly ingenious mechanical productions.

CHAPTER XII

NOTES ON THE SETTLER'S HOME¹

Simple shelter — (1) "Dug-outs" — (2) Log-cabins — (3) Manufactured timber houses—Heating arrangements—Supply of fuel and water—Clearing the land—Snake fences.

THERE is perhaps no sight more suggestive of the energy and endurance of settlers in a new country than the original houses in which families have resided, and which are yet to be seen in many of the British Colonies. In those countries where the temperature is high, simple shelters in the shape of tents are all that are at first attempted; but in many of the American States and in Canada, where the winters are severe, something more is needed; in fact, a house must be built, and so constructed as to afford protection during the winter months, when the thermometer often registers such an intense degree of frost as is unknown in Great Britain.

Dug-outs.—In an open prairie country a house termed a "Dug-out" is frequently seen, and may be described as a trench cut into the slope of a steep bank facing the south, and covered with logs, on which earth is piled up to form a roof, the roof being finally thatched with grass or reeds. By cutting into the slope of the bank, sufficient height is soon attained to allow both ends of the roof-logs to rest on the solid ground, the distance between the two gable walls being determined by the length of the logs, while the width of the room, the distance between the open front and the solid bank which forms the back-wall, is entirely dependent upon the space required and the amount of labour which may be expended. In cases where the slope is sufficiently steep, the bank often forms

¹ *Editor's Note.*—The subject of house-building will be fully dealt with in another volume of this series by Professor Lyon, of the Royal College of Science, Dublin.

the front wall also, and only the door is cut out, so that the four walls are solid. A second trench is cut out to form a space in which the cooking is carried on. Open drains are cut so as to divert the surface water and prevent its flowing down the bank upon the site of the dwelling. Those only who have been exposed to the extremes of temperature common in many newly-settled countries can understand the comfort to be obtained in a "dug-out," with its solid wind-proof walls.

Log-Cabins.—In a timber country log-houses are built, and as these are substantial, on account of the size of the logs used, they are often left standing to answer the purpose of store-rooms on farms, after more pretentious and commodious dwellings have been built. In selecting the site of a log-house, four trees are often left to form the corner supports, and, if these are not available, four thick, round logs are placed in the ground as uprights, and the walls are built up of logs laid longitudinally one on the top of the other, till sufficient height of side and gable-walls is attained. These wall logs are often squared and dovetailed into each other at the corners, clay and grass being used as mortar and placed between each log. As in the case of dug-out dwellings, the roof is formed of long logs covered with soil and thatched; and it can be easily understood, if the thatch has been properly attended to, that these old buildings, mud-plastered inside and whitewashed, form cool, clean, summer dairies on many a farmer's homestead after they have answered the original purpose as a dwelling-house for the family.

Houses of Manufactured Timber.—A common style of settler's home, when situated where manufactured timber is available, may here be described. It is one built of timber boards, and the style of architecture seldom varies. A foundation of stone about twelve inches high is laid on the ground. On this the floor joists are placed, so that the floor may extend in front and at the two gables beyond the proposed dimensions of the house to be built. This surplus area is roofed along with the house, to form a verandah in front and at each gable. An apartment having a lean-to roof is built at the back, and forms a kitchen, cooking-place, and general store-room.

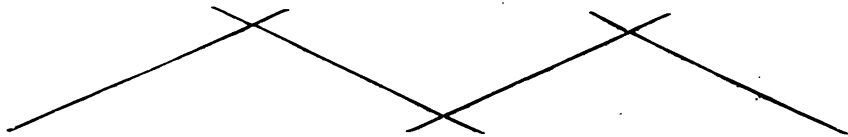
Heating Arrangements.—The outer frame, or skeleton, of the settler's home has alone been dealt with, since the internal arrangements, being entirely dependent upon the tastes, habits, and resources of the family, are simply matters of detail. In one particular, connected with the internal arrangements, there is a striking difference between the New World farmhouse, whether a log-cabin or a more pretentious one built of manufactured timber, and those common in Britain. This is in the arrangement and construction of the fireplaces. In America one never sees a built range or grate, stoves being invariably used. These stoves are set well forward from the wall, so as to raise the temperature of the rooms, and, being closed, they are cleanly, and are so constructed as to economise fuel. The flue, a metal or tin tube carrying off the smoke, is so jointed that it can easily be disconnected from the outside chimney-stalk. In summer the stove is moved from the front room to the back-kitchen, where the cooking is done till the return of the cold weather.

Supply of Fuel and Water.—In a prairie country the question of fuel is equally important with that of water. To those who have lived within reach of a shipping port, a canal, or a railway, where coals are always obtainable, it may seem hard to understand that great tracts of land suitable for cropping have had to lie waste and uncultivated simply on account of the want of fuel to maintain fires in the settlers' cabins. Incredible as it may seem, had it not been for the dried droppings termed "Buffalo chips," found in abundance on many of the Western prairies and turned to account as fuel, many a district now covered with homesteads could not have been reclaimed. Almost the first business to be attended to by a settler on those open tracts was to plant near his house a number of quick-growing shelter trees. These in a few years came to be useful in many ways, every spare branch or twig being husbanded as fuel. After the first crop of grain had been reaped, the difficulty regarding fuel diminished, as not only the straw of the wheat, but even the corn-cobs and stalks of the maize or Indian-corn, were used as fuel. Situated as many were beyond the reach of railways or other means of communication, the surplus maize was of little value, and was often used as fuel, and

to-day the shelled maize cobs constitute the principal substitutes for coals or firewood on many a Western farm.

Clearing the Land.—While the prairie-land farmers have the fuel difficulty to contend with, those in a timber country must depend upon fire and its destructive action to assist them in clearing land for cultivation. Until the settler has got rid of the undergrowth and the smaller trees, he cannot put the plough in the soil; and even with the assistance of fire, the work of reclaiming timber lands is in most cases a very arduous one. The system generally pursued strikes one who has been accustomed to look upon a growing forest as valuable to be wasteful in the extreme. A portion of forest land is selected, and a few of the most valuable of the trees having been cut and hauled out beyond a line fixed upon, the underwood is cut and piled round the growing timber. After drying for a time, and waiting the opportunity when the weather is quiet, the piles are lighted and fires are maintained till as much as possible of the standing timber is consumed. Trees, however, being full of sap, and more especially if they are of any size, resist the action of fire, and in consequence, in a country reclaimed from the forest, black charred trunks are seen standing in the midst of corn and other crops many years after the original reclamation has been carried out.

Snake Fences.—In timber countries what are termed "snake fences" are constructed, not only as boundary fences in the forest, but as field-divisions. Straight-grown trees are selected and split up by the axe, cut into equal lengths of twelve to fifteen feet, and a fence shaped as in plan:—



is constructed by placing one rail on top of the other till sufficient height is attained, an upright being placed in each outside angle to keep the rails in position. Some

idea of the changes which take place in a new country, through the extension of railways and other means of communication, may be gathered from the fact that fields may be seen enclosed by snake fences, the split timber being of the very finest and most valuable description of walnut. Had the timber, so valueless at one time, been left standing, it would have been worth more to-day than the land it now encloses.

APPENDIX ON PRESERVED AND CONCENTRATED FOODS

BY

C. AINSWORTH MITCHELL, B.A. (Oxon.), F.I.C., F.C.S.

SINCE a considerable amount of time must elapse before an emigrant to a new country can obtain sufficient food for himself from the land which he proposes to cultivate, the first questions to which practical answers must be given are: What kind of food must I take with me? and what will suffice until I can obtain food supplies in the way described in the earlier part of this book? The following remarks on the composition, nutritive value, and preservation of food may perhaps assist the reader in forming his judgment on this important point.

I.—*FOOD FROM A CHEMICAL POINT OF VIEW.*

There is no single natural product which in itself is capable of supplying the chemical elements to repair the loss which is ever going on in the human frame, and man must therefore derive his nutriment from a variety of sources. It is necessary, too, that the elements should be in certain forms of combination, for neither animals nor plants can assimilate an element (such as carbon, for example) in its simplest form. Whilst vegetable life can split up and utilise such simple compounds as carbon dioxide and ammonia, the carbon and nitrogen compounds required by the animal are of a much more complex nature, and, except in so far as some of them have been prepared in the laboratory, are formed during the life-processes of plants or of other animals. Thus, directly or indirectly, animal life is dependent on plant life.

The compounds of which man's food consists may be grouped into the five classes—water, mineral matter (salts), fat, carbohydrates, and proteids.

WATER.

Water, although not dissociated into its components—hydrogen and oxygen—is a very essential part of human diet, for it composes the greatest portion of the different fluids of the body, and is present in every kind of tissue. Apart from the obvious fact that it constitutes the chief part of different beverages, it is also present in varying quantities in every description of animal and vegetable food. Thus, for example, beef contains approximately 75 per cent. of water; fat pork, 48 per cent.; lean pork, 73 per cent.; salmon, 65 per cent.; bread, 36 per cent.; whilst potatoes contain 75 per cent.

MINERAL MATTER.

The facts that bone largely consists of calcium phosphate and calcium carbonate, that iron is a constituent of the colouring matter of the blood, and that common salt or sodium chloride is found in the blood, and is required for the formation of the gastric juice, are sufficient to show the necessity of mineral matter in human food. Experiments made by the French Academicians in the early part of the century clearly established this in a practical manner. A dog fed daily upon 4 oz. of meat which had previously been thoroughly boiled and pressed, so that the bulk of the soluble salts had been removed, lost one-fourth of its weight in forty-three days, and after fifty-five days became so emaciated that it could hardly eat its portion.

The salts mentioned above, as well as other necessary mineral matter, occur in food both of animal and vegetable origin, and remain as ash on burning away the carbonaceous matter. Thus, the following percentages of salts have been found:—in mutton, 1.3; rabbit's flesh, 1.1; goose, 0.5; milk, 0.7; cane-sugar, 0.6; beans, 3.0; wheat bread, 1.2.

FAT.

Fat is an equally necessary constituent of food, and experiments have shown that an animal fed upon substances deprived of all fat speedily dies. The principal use of fat in the body is the production of heat, as it is rapidly converted into carbon dioxide and water by the oxygen of the air inhaled by the lungs; this process is accompanied by the evolution of heat, and is virtually a slow combustion. For this reason the inhabitants of Arctic regions devour enormous quantities of whale-blubber or walrus fat. Fat also serves to protect the nitrogenous compounds in the

body from being broken up, and possibly some of it may be absorbed in an unchanged condition.

With the exception of certain nuts and seeds, man derives the greater part of the fat he requires chiefly from the animal kingdom. Thus in butter there is about 88 per cent. of fat; in milk, about 4 per cent.; and there are large but varying amounts in different kinds of flesh. But small quantities occur in every sort of food, as, for instance, in bread, which contains about a half per cent.

CARBOHYDRATES.

Carbohydrates include sugars, starches, gums, dextrins, &c. Like fat, they undergo, at least partially, a slow combustion, and contribute to the heat of the body. Moreover, like fat, they help to protect the albuminoid compounds of the body, and it has been proved that a large proportion of the fat of the body is derived from carbohydrates. Cellulose, which may be referred to here, is closely allied to wood-fibre, and is the chief constituent of the cellular walls of plants. In the light of Wilsing's experiments, it appears to have a definite nutritive value; but, apart from this, it must not be lost sight of that, even when cellulose and similar substances are not digested, in all probability they have a high negative value as mechanical stimulants to the action of the intestines. The various substances classified under this head occur for the most part in the vegetable kingdom.

PROTEIDS.

The proteids, which constitute the fifth group of food constituents, are the most important of all. They are very complicated nitrogenous compounds, containing carbon, hydrogen, oxygen, nitrogen, and sulphur, and are found both in the animal and (to a lesser extent) in the vegetable world. Albumin, or coagulated white of egg, may be taken as a type of an animal proteid, and the similar nitrogenous compounds which are present in beans and in wheat flour as types of the vegetable proteids. They are all marked by great instability, and are readily broken down into simpler compounds under the influence of different agents. Albumin, for example, is so acted upon by the digestive ferments that it is largely transformed into soluble substances, which, for the most part, can be absorbed into the blood. It is from such transformed proteids that the tissues of the body are built up, whilst that portion of the proteid which is not absorbed is also changed into simpler nitrogenous compounds, and passes off from the body together with other waste products.

Hence, in estimating the food-value of any given substance, it is not sufficient to state that it contains so much nitrogen, or even nitrogen in the form of proteids, but account must also be taken of its capacity for becoming assimilated. Gelatin, for instance, which is of a proteid nature, and has a very similar elementary composition to albumin, is held by many chemists to be quite worthless as food.

The amount of proteids required each day by an average adult is, according to König, 118 to 150 grammes (about 3.8 to 5 oz.). Voit gives as the minimum quantities of the different constituents of food necessary for an adult:—Proteids, 114 grammes (4 oz.); fat, 56 grammes (1.9 oz.); carbohydrates, 500 grammes (about 17.6 oz.).

To supply this minimum of proteids by any one kind of food, the following quantities would on the average have to be taken:—

	Ounces.
Beef	19
Mutton (lean)	24
Cheese	14
Milk	119
Bread	57
Beans	20
Potatoes	188

A further point to be taken into consideration is that some of the proteid nitrogen usually remains undigested, and that a considerable variation would probably appear in the above figures if they were calculated on the amount of digestible proteid substances. Thus, in the case of bread, Rübner found that it might happen that only half of the total proteids was absorbed, and in that case a considerable increase would be necessary in the figure given above, so as to obtain results comparable with those given by the more digestible animal proteids.

Whilst the necessary amount of proteid nitrogen might be obtained entirely from the vegetable kingdom, as in practice is done by the stricter vegetarians, yet, even if such highly nitrogenous substances as peas and beans formed a principal part of the diet, the amount of the other vegetable constituents (cellulose, &c.) required would be inconveniently large, and a considerable strain would be put upon the digestive organs. Hence a mixture of animal and vegetable diet appears to be best suited to man's requirements.

In the following table is given the average percentage composition of some of the more common articles of food. The "nitrogen-free substances" include the sugars, starches, cellulose, &c., but not the fat or mineral matter, which are separately tabulated:—

Food.	Water.	N. Sub- stances, chiefly Pro- teids.	N.-Free Sub- stances other than Fat and Ash.	Fat.	Mineral Matter.	Calculated on the Dry Substance.		
						Pro- teids, &c.	N.-Free Sub- stance.	Fat.
Beef	72.03	20.96	0.46	5.41	1.14	74.95	1.64	19.33
Mutton (lean) .	75.90	17.01	...	5.81	1.28	70.58	...	24.10
Pork (fat) . .	49.30	14.68	...	35.28	0.74	28.95	...	69.58
Pork (lean) . .	70.48	20.53	...	7.65	1.34	69.54	...	25.91
Rabbit	66.55	21.77	0.75	9.55	1.17	65.09	2.24	28.53
Herring	74.64	14.55	...	9.03	1.78	56.42	...	35.85
Milk	87.34	3.36	4.70	3.84	0.76	28.90	37.12	30.33
Cheese	33.89	27.56	1.90	33.00	3.65	41.58	2.88	49.69
Bread	35.59	7.06	55.80	0.46	1.09	10.96	86.63	1.75
Beans	15.25	19.43	60.40	1.63	3.29	22.92	71.26	1.92
Peas	12.40	20.21	63.16	1.35	2.88	23.09	72.10	1.54
Potatoes . . .	72.25	2.12	23.69	0.08	0.86	7.63	85.37	0.28
Onions	85.99	1.68	11.53	0.10	0.70	12.25	82.42	5.14

The above figures show that there is an enormous variation in the percentage of water in different food-products ; and, in order to obtain a comparative view of the composition of the solid matter present in each, reference must be made to the results given in the three columns on the right.

II.—PRESERVED FOODS.

When a supply of food has to be selected in sufficient quantity to last the consumer for a lengthy period, with the possibility of his being unable to renew any of the articles, the chief points to be considered are, firstly, how is food best preserved ; and, secondly, in which way can the greatest amount of nutriment be compressed into the smallest bulk. Both of these points are elucidated by a consideration of the principles underlying the decomposition of organic matter.

Putrefaction is the result of a process of disintegration brought about by means of bacteria in the atmosphere, which break up nitrogenous substances (proteids) into simpler bodies, many of which are deadly poisons to the human system, although somewhat approximating in composition to the compounds formed at certain stages of the digestive process. For the activity of these bacteria certain conditions are essential, the principal being the presence of a sufficient quantity of moisture and of a certain degree of heat.

PRESERVATION BY COLD.

At low temperatures the bacteria or their spores remain quiescent, and are unable to effect any change in the medium on which they may have settled. Thus it is that the flesh of the extinct mammoth, embedded in the Siberian ice, has been preserved from prehistoric times to the present day in an absolutely unchanged condition. Whilst freezing is undoubtedly one of the most satisfactory methods of preserving meat, since the flavour is but little affected, it has the drawback that a low temperature must be constantly maintained until the food is required for use.

PRESERVATION BY DRYING.

The removal of water is in many cases a very satisfactory method of preserving perishable articles of food, and is one more generally applicable than freezing. The weight of the substance is considerably lightened, and the putrefactive bacteria are unable to obtain a footing so long as the food is kept in a dry place. Examples of this method of preserving are seen in dried flesh, such as pemmican, and in dried vegetables and fruits.

PRESERVATION BY ANTISEPTICS.

The addition of salt acts partly as an antiseptic, and partly through its combination with the water in the substance, as, for example, in the case of salt beef and salt fish. The preservation of cured hams is very largely owing to the tarry substances in the wood-smoke with which the meat-fibre becomes impregnated, so that it is no longer a suitable culture-medium for the bacteria. The addition of such chemical antiseptics as salicylic acid, boric acid, and similar substances, is now a very common practice; but, taking into account the ill effects of many of these on the digestive organs, it is one which should be avoided.

PRESERVATION BY STERILISATION.

Heat-sterilisation has now been applied to almost every description of food, more especially in England and America. The substance to be preserved is placed in cans, which are soldered up, leaving only a small hole. These are then subjected to a high temperature, preferably accompanied by moisture, on successive days, so as to destroy all germs, and, finally, the hole is soldered up.

Care should be taken to avoid *cans containing any solder inside*, as most of the cases of lead-poisoning from tinned meats have been traced to this cause. With the object of preventing all risk from this source, some firms line the interior of the tin with a kind of silicate enamel, so that the meat never comes in contact with the metal. Others sterilise the food in jars or glass vessels; but this method has the drawbacks that the hermetic sealing-up is much more difficult, and that the vessels are readily broken in transit.

FOOD-SUPPLY OUTFIT FOR PROSPECTORS.

Assuming that the prospector will always have access to a sufficient supply of water, preservation by drying must be regarded as the most generally suitable of the methods touched upon above.

A sufficient quantity of dried flesh, or pemmican (which was first prepared from buffalo-flesh in America, but which now usually consists of beef), should be taken, say from 20 to 30 lbs. by each person if the expedition is likely to last for a year. This may be supplemented by corned beef and tinned mutton, which contain some 15 per cent. less water than the fresh meat (say about 30 lbs.), by bacon and by ham (say 100 lbs. of each).

Extract of meat will be found valuable as a stimulant; but obviously the more fluid preparations should be avoided where space is likely to be limited. Three or four pounds should be found sufficient, with the addition of a quantity of the various desiccated and compressed soups now in the market. These, like extract of meat, should be regarded rather as stimulants than as foods.

As will be seen on reference to the foregoing table of the composition of the different kinds of food, beans and peas have a very high nutritive value on account of the proteid nitrogen which they contain; and they should therefore form a principal item of the vegetables selected. Suitable quantities of these in the dried state would be 40 to 50 lbs. of each; and 10 or 20 lbs. of lentils, which are very similar in composition, might also be taken. Evaporated onions, in which most of the water has been removed at a low temperature, and potatoes similarly treated, should also find a place in the material selected. The composition of these would approximate very closely to that calculated in the right-hand side of the food table for the substances free from moisture; but in practice there is always a certain percentage of water left in these and in similar dried products.

A large supply of oatmeal, with smaller quantities of rice, sago, and tapioca, is advisable. Of dried fruits a choice may be made

from apple rings and cored apples, evaporated pears, apricots, and peaches and prunes. About 150 lbs. in all would probably be found sufficient.

In place of bread, various kinds of compressed biscuit might be taken; or, assuming a sufficient knowledge of baking, flour (say 250 to 300 lbs.), with the necessary amount of baking powder for making bread, would be preferable. Suet can now be obtained in compact blocks, which are freed from all animal tissue and the more liquid fat, and which will consequently keep indefinitely.

In this connection mention may be made of a special kind of biscuit containing both meat-fibre and vegetables. These have been found of the greatest service by soldiers on the march.¹

As prepared by the better-class firms, condensed milk consists of ordinary whole milk mixed with a certain percentage of sugar (which acts as a preservative), and evaporated to a paste. Quite recently a desiccated milk has been prepared in Berlin.² This is a product practically free from water. It keeps for an indefinite length of time in a stoppered bottle, and, on the addition of the right proportion of water, yields a liquid closely resembling the original milk. It is obviously preferable to ordinary condensed milk, both on account of its containing so much less water, and of its being free from admixture with any foreign substance such as sugar.

By the addition of large quantities of salt and of glucose, butter is now preserved for export to tropical countries. This method has been found very satisfactory by the manufacturers in France and America, and would probably be of service to the prospector, especially if the butter were kept in air-tight tins. Cheese is to be recommended as a food, by reason of the large amount of digestible nitrogenous substances it contains.

In the matter of beverages, such as tea, coffee, and cocoa, the intending prospector will be largely guided by his own tastes. But it should not be lost sight of that cocoa, unlike tea and coffee, which are only stimulants, contains a considerable percentage of digestible proteid nitrogen, and is, therefore, both a stimulant and a food.

Sugar (say 100 lbs.) should be chosen in as dry and compact a state as possible.

From 15 to 20 lbs. of salt would be essential; but as regards other condiments, such as pepper, vinegar, mustard, and spices, the quantities required would, as in the case of beverages, largely depend upon the personal tastes of the consumer.

¹ Spratt's patent.

² Passburg's desiccated milk.

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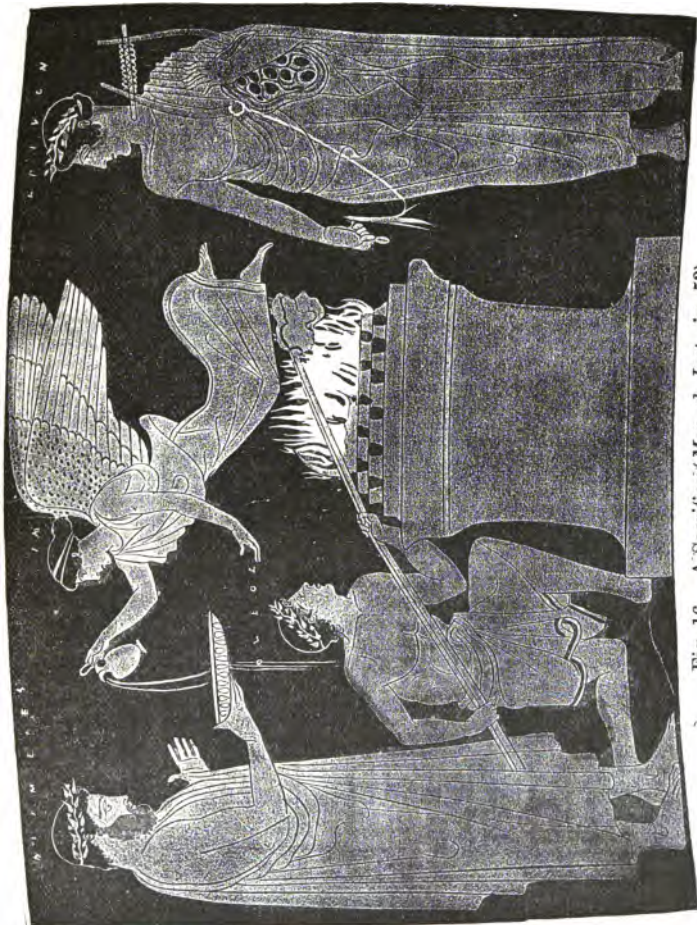


Fig. 16.—A Sacrifice (*Mon. d. Inst.*, ix. 53).

The representation is of a sacrifice to Apollo (who stands on the right). An attendant holds some flesh on the fire on a long spit. Victory herself provides wine for the libation.

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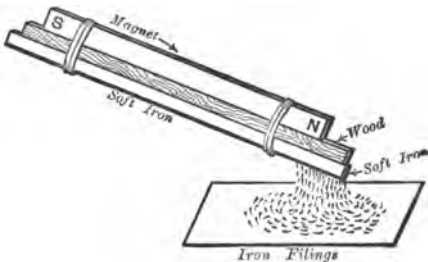
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